2018 Alaska Housing Assessment

Statewide Housing Characteristics

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4300 Boniface Parkway • Anchorage, Alaska 99504 • P.O. Box 101020 • Anchorage, Alaska 99510
907-338-6100 (Anchorage) or (Toll-Free) 1-800-478-AHFC (2432) • www.ahfc.us

Project Team:

Nathan Wiltse | Dustin Madden

Prepared by:

Cold Climate Housing Research Center

cchrc.org

P.O. Box 82489

Fairbanks, AK 99708

Phone: (907) 457-3454

Fax: (907) 457-3456

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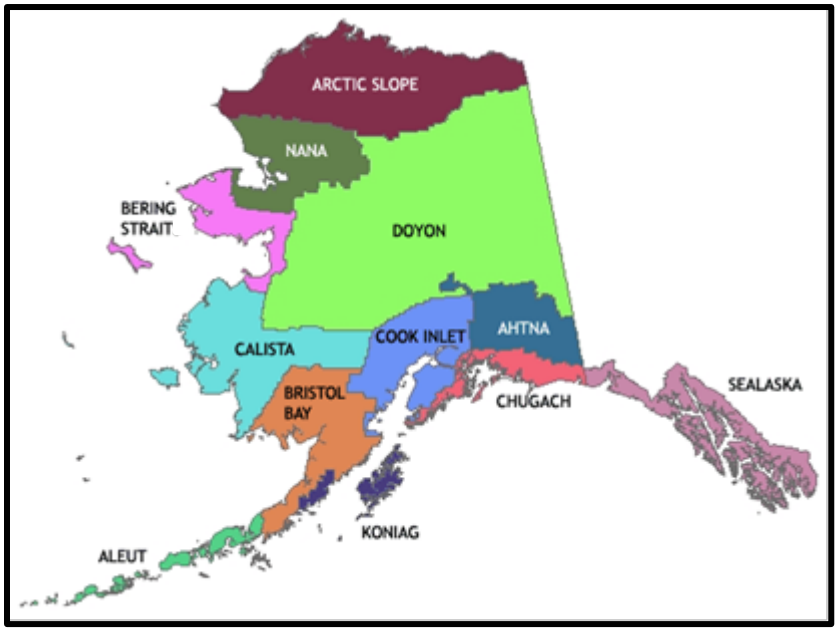
Introduction

In this section, researchers compare regions created by the Alaska Native Claims Settlement Act (ANCSA) shown in Fig. 1.

Figure 1: ANCSA regions



This section of the Alaska Housing Assessment identifies conditions and trends present in existing housing stock. The purpose is to determine condition of existing stock and to help stakeholders make informed decisions consistent with their priorities. This study follows others completed for Alaska Housing Finance Corporation (AHFC) that were published in 2005, 2009 and 2014 respectively.

This assessment examines five broad categories: **community, overcrowding, energy, affordability and housing condition.** This section details characteristics associated with housing in each category. For a summary of current housing challenges in Alaska see the Statewide Housing Summary report that evaluates housing challenges, including overcrowding, affordability, moisture and indoor air quality risks, inefficient homes, senior housing and needs created by population demographic trends.

Throughout the Alaska Housing Assessment, data about the five categories identified are presented at a variety of spatial scales from statewide to census areas. This section presents data at the statewide and ANCSA region spatial scales. Where possible, data are compared against national numbers to provide context and additional reference points.

The Alaska Housing Assessment includes written stand-alone summaries for each ANCSA region and census area. These detailed data profiles are available on AHFC's website for the

ANCSA region and census area levels.[1] These data profiles highlight characteristics in each study area and allow more dynamic comparisons.

[1] https://ahfc.us/efficiency/research-information-center/alaska-housing-assessment/2018-housing-assessment/

Data Sources

Researchers used data from a wide variety of sources to evaluate Alaska's housing characteristics and needs for this report. Primary sources of data used in this evaluation of housing include U.S. Census Bureau's American Community Survey (ACS) and energy ratings obtained from AHFC's Alaska Retrofit Information System (ARIS) database. Older versions of these two data sources were used in the 2014 Housing Assessment produced for AHFC.

New data sources used in this 2018 housing assessment include housing and population data from Alaska Department of Labor's research division, power cost equalization data obtained from the Alaska Energy Data Gateway, property tax assessment data from urban areas throughout the state, national energy usage from the U.S. Department of Energy's Residential Energy Consumptions Survey (RECS) and data from other regional and local housing assessments.

ACS is a survey conducted every year by U.S. Census Bureau on a statistically representative random sample of households, intending to target 2.5 percent of the population. While the decennial census counts numbers of people, the ACS gathers data on demographic, social, economic and housing characteristics. Results are released in one-, three- and five-year period-averaged estimates. This report uses the 2010 to 2014 five-year estimates for Alaska, which is based on 42,574 randomly sampled surveys.[2] These surveys are conducted via questionnaires, telephone surveys, and in the case of rural Alaska, in-person interviews. While data does have its drawbacks, it is the most reliable source for demographic information reported in this assessment.

ACS data are estimates based on statistical samples and thus have margins of error. Margins of error varies depending on sample size and number of households surveyed. ACS data are reasonably reliable in larger urban areas but can have large margins of error in small communities due to smaller sample sizes. For brevity, margins of error are not included with ACS data reported herein, but researchers can use the American Fact Finder website to access margins of error for particular quantities.[3]

Census and ACS data provide information on total population, total housing units, income, household size, home age, occupancy, overcrowding, housing costs and affordability. Alaska Department of Labor and Workforce Development data provide information about Alaska regional population trends and projected aging population. Where available, data are reported at census area, regional and state level.

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[2] U.S. Census Bureau. (2017). *American Community Survey: Sample Size*. Retrieved from: https://www.census.gov/acs/www/methodology/sample-size-and-data-quality/sample-size/index.php

[3] Available at http://factfinder2.census.gov

ARIS contains energy ratings and assessments produced as homes are evaluated under AHFC's Home Energy Rebate Program or Weatherization Assistance Program or when they receive a new construction certification through AHFC's Building Energy Efficiency Standard (BEES). Home evaluations include energy ratings using AHFC's AKWarm modeling software to characterize basic features and construction type in addition to their energy performance. Data from ratings are uploaded into ARIS. Data for this study were retrieved from ARIS in April 2016. At that time, ARIS contained data from more than 112,800 Home Energy Rebate ratings and weatherization assessments gathered from either pre- or post-energy retrofit homes or from new construction certifications (BEES). These ratings and assessments cover more than 85,800 units at unique addresses. This number represents approximately 27 percent of Alaska's roughly 303,417 total housing units and approximately 34 percent of Alaska's occupied housing stock.[4] ARIS rating data provide information about energy use and efficiency, energy costs, air tightness, ventilation and rates of participation in energy programs.

The most recent nationally representative data available on household energy characteristics is U.S. Energy Information Administration's 2009 Residential Energy Consumption Survey (RECS), which estimates household energy characteristics using a survey of approximately 12,100 randomly sampled housing units nationwide.[5] These RECS estimates are used to provide context for Alaska's energy characteristics. RECS estimates are presented for a variety of different categories, including geographic location, climate zone and fuel type among others. In addition to numbers for the nation as a whole, RECS estimates reported here are for the U.S. western region and for "cold/very cold" climates; the boundaries of these regions can be found in Fig. 2 and Fig. 3 below. Alaska is considered part of both sub regions of the U.S., despite not being shown in the climate region map.

[4] Per the U.S. Census Bureau, "a housing unit is a house, an apartment, a group of rooms, or a single room occupied or intended for occupancy as separate living quarters. Separate living quarters are those in which the occupants do not live and eat with other persons in the structure and which have direct access from the outside of the building or through a common hall."

[5] The comparable data from the 2015 RECS is not scheduled to be released until 2017/2018.

Figure 2: 2009 Residential Energy Consumption Survey / Building America climate zones

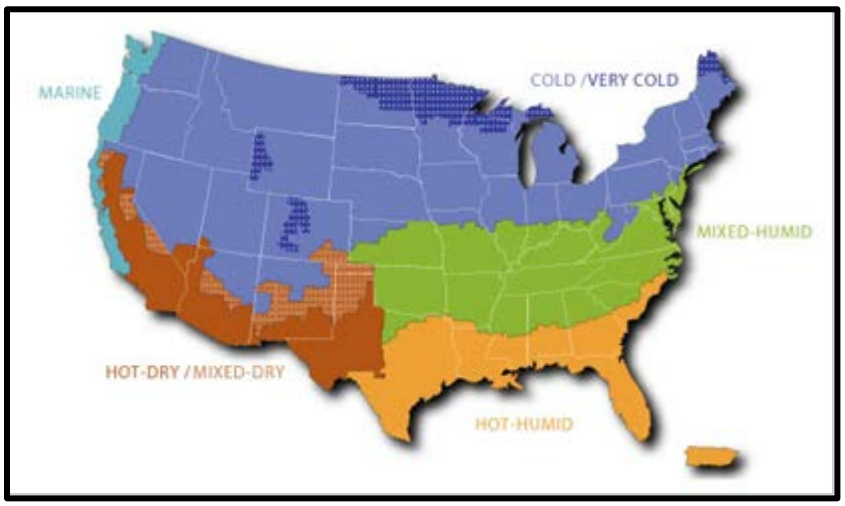
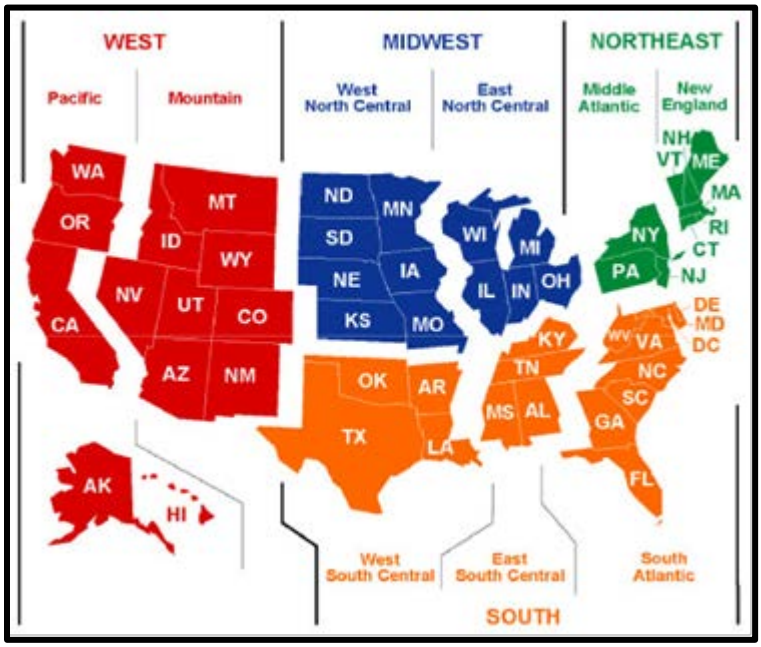


Figure 3: 2009 Residential Energy Consumption Survey regions[6]



Electricity data used to estimate total energy use and costs came from power cost equalization (PCE) data available on the Alaska Energy Data Gateway for communities participating in PCE and from Institute of Social and Economic Research's *Alaska Energy Statistics* report for other areas in state.[7, 8]

[6] Retrieved from https://www.eia.gov/consumption/residential/reports/2009/16-states.php
[7] Available at https://akenergygateway.alaska.edu/
[8] Fay, G., Villalobos, A., & West, C. (2014). Alas*ka Energy Statistics 1960–2011, Final Report.* Retrieved from http://iser.uaa.alaska.edu/Publications/2013_12-AlaskaEnergyStatistics2011Report_Final_2014-04-30.pdf

Property tax data was obtained for several regions throughout Alaska, including Municipality of Anchorage, Mat-Su Borough, Kenai Peninsula Borough and North Slope Borough. This data was used to report on the housing condition and quality as identified by property tax appraisers in each region, which is available on the housing assessment profiles on AHFC's website.[9]

While researchers believe that data used in this report provide the best available information on housing in Alaska, all data sources used in the assessment have limitations. For a detailed discussion of these limitations, see Appendix B: Data Limitations.

[9] https://ahfc.us/efficiency/research-information-center/alaska-housing-assessment/2018-housing-assessment/

Community

To understand current and future housing challenges in Alaska, it is useful to consider demographics and current housing stock of communities and regions. This section covers information about current and projected population levels, current housing stock, population and housing for senior citizens older than the age of 65, and households with young dependents.

Alaska's estimated population of 739,828 represents only 0.2 percent of 324 million people living in the United States, yet its residents are scattered throughout an area roughly one-fifth the size of the contiguous United States.[10, 11] The majority of population is concentrated in Southcentral Alaska, but the state has a higher percentage of people living outside of large urban areas, 55.5 percent, than the nationwide rate of 28.8 percent.[12] Nationally the population grew 4.1 percent between 2010 and 2015. Alaska's population grew 3.9 percent despite a large net migration out of state during this period.[13]

According to Alaska's state demographer, Alaska's senior population is expected to nearly double across all regions by 2030.[14] Statewide there are an estimated 74,853 seniors or 10.1 percent of Alaska's total population. The number of seniors is estimated to increase to 140,120 or 17 percent of Alaska's total population by 2030.[15]

Population Growth

Populations are growing in many regions, and rate of construction of new housing units is not sufficient to meet projected demand from this growth and threatens families with overcrowding and/or homelessness. The number of new housing units required to meet population growth in 2020 and 2025 was calculated by dividing projected number of new people by average household size in each region.[16, 17] This demand for new housing was then compared to new construction projections created by first calculating average construction

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[10] Alaska Department of Labor and Workforce Development, Research and Analysis Section. (2016). *2016 Population Estimates.* Retrieved from http://live.laborstats.alaska.gov/pop/

[11] Alaska Department of Labor and Workforce Development, Research and Analysis Section. (2016). *2016 Estimates.* Retrieved from http://live.laborstats.alaska.gov/pop/

[12] Defined as areas with more than 50,000 people. See http://www.census.gov/geo/reference/ua/urban-rural-2010.html for a more detailed definition (November 2016).

[13] Hunsinger, Eddie, Sandberg, E., & Brooks, L. (2016). *Alaska Population Projections 2015 to 2045*. Alaska Department of Labor and Workforce Development, Research and Analysis Section.

[14] Seniors are defined as individuals 65 years old or older.

[15] Hunsinger, Eddie, Sandberg, E., & Brooks, L. (2016). *Alaska Population Projections 2015 to 2045*. Alaska Department of Labor and Workforce Development, Research and Analysis Section.

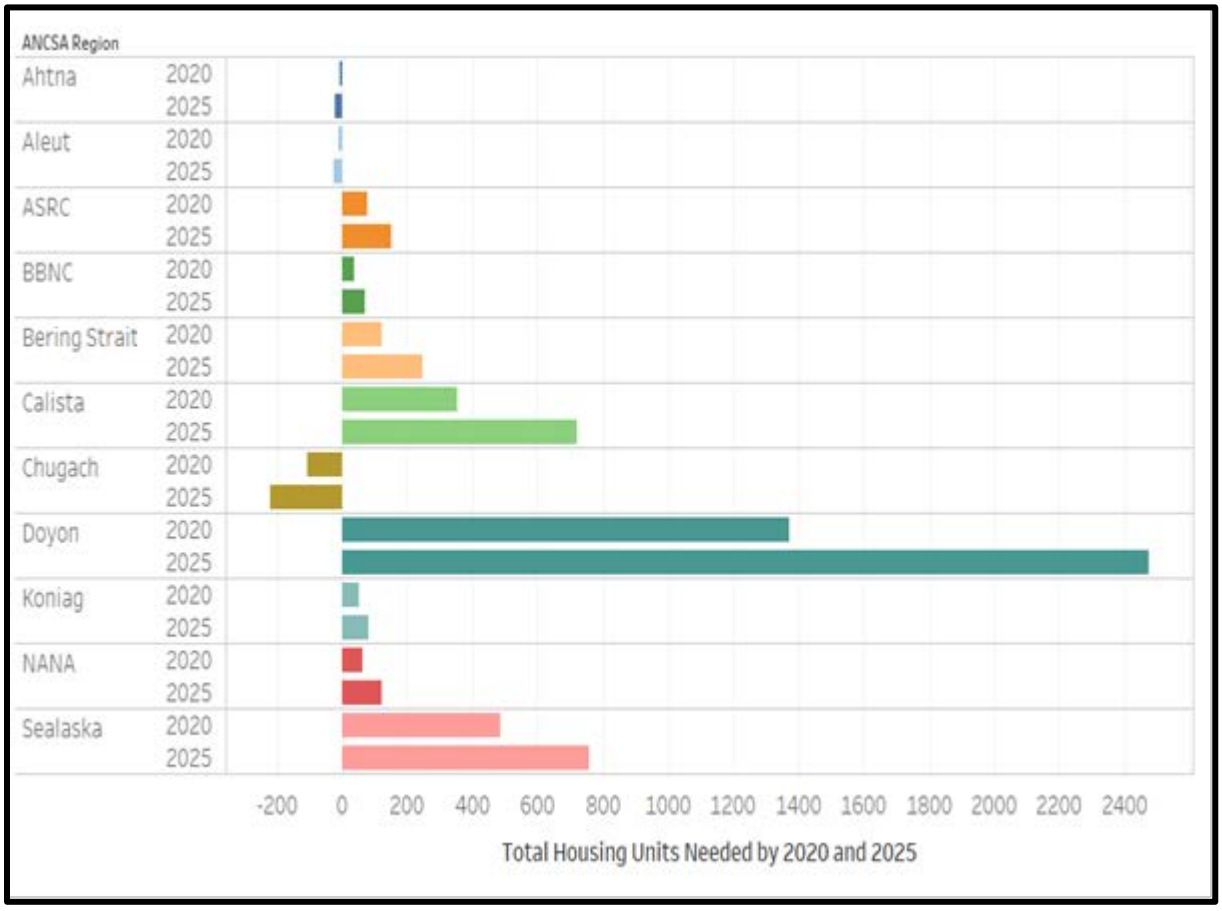
[16] Ibid.

[17] U.S. Census Bureau. (2016). *American Community Survey, 2010–2014 American Community Survey Five-year Estimates*. Retrieved from http://factfinder2.census.gov

rate over the past five years for each region and then using this rate to extrapolate an estimate for number of new units built by 2020 and 2025.[18]

Fig. 4 shows these estimates of housing need caused by projected population growth for all regions except the CIRI region. Due to its large population size and equivalently large housing need due to projected population growth, the CIRI region is omitted from Fig. 4 so that detailed needs of the state's other regions can be shown. For comparison, the CIRI region needs an estimated 9,650 housing units by 2020 and 18,675 by 2025 to account for projected population growth.

Figure 4: Estimated new housing units needed to meet projected population rrowth

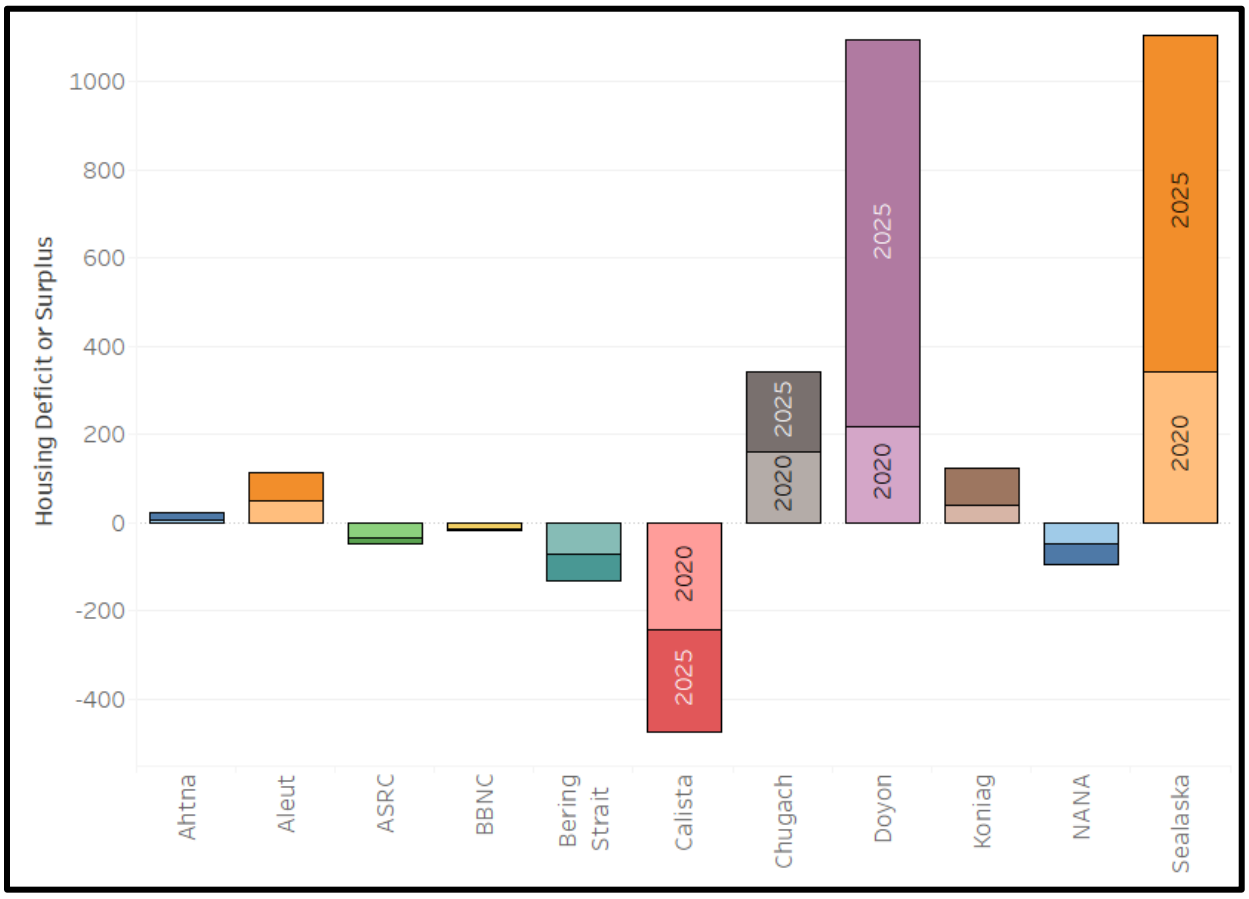


Note that Fig. 4 does not include projected future housing construction, only the need from projected population growth.

[18] Dusenberry, Nicole. Personal email communication, 5/9/2016. *2000–2015 New Housing Units Workbook*. Alaska Department of Labor and Workforce Development, Research and Analysis Section.

Fig. 5 shows results of comparing demand for housing with projected new housing construction. This comparison highlights which regions will have a housing deficit if they continue with the same pace of new construction and which regions will have a surplus of housing if they continue with the same pace of construction. New construction projections were created by calculating average construction rate over the past five years for each region and then using this rate to extrapolate an estimate of new units built by 2020 and 2025.[19] Housing deficits are shown as negative numbers and projected housing surpluses are shown as positive numbers.

Figure 5: Housing deficit or surplus from population growth and current rate of construction



Note that the CIRI region is not included because its population is on a different scale. The CIRI region has a very large projected housing deficit due to projected population growth outpacing recent construction rates, with an estimated 4,330 additional units beyond the current projected rate of construction required to meet this demand. It is important to note that even areas projected to have a surplus with projected rate of construction still will very

[19] Dusenberry, Nicole. Personal email communication, 5/9/2016. *2000–2015 New Housing Units Workbook*. Alaska Department of Labor and Workforce Development, Research and Analysis Section.

likely *not* have too many housing units, as most regions have a significant amount of overcrowding to overcome first.

Housing Stock

Alaska shares some similarities with the nation as a whole. There are comparable percentages of renters (37 percent for Alaska and 34 percent for the U.S.) and homeowners (63 percent and 66 percent). Both the U.S. and Alaska have similar proportions of detached single-family homes, at 62 percent and 63 percent. Alaska has a greater percentage of multifamily buildings with fewer than 10 units (17 percent; U.S. 13 percent). Nationally there are more large multifamily buildings with 20 or more units as part of the housing stock (8.6 percent) than in Alaska (4.8 percent).

The age of housing stock in Alaska differs significantly from the nationwide average, with more than half (51 percent) of all housing units in Alaska estimated to be built in the oil pipeline boom days of the 1970s and '80s. Nationally, 31 percent of the housing stock was built during the same period. Nationally more than 40 percent of housing units were built before 1970. In Alaska, 19 percent of existing housing was built before 1970.[20]

Senior Housing

According to Alaska's state demographer, Alaska's senior population is expected to nearly double across all regions by 2030.[21] Statewide there are an estimated 74,853 seniors or 10.1 percent of Alaska's total population. The number of seniors in Alaska is estimated to increase to 140,120, or 17 percent of Alaska's total population, by 2030.[22] In Alaska approximately 6.8 percent of seniors live in assisted or independent housing facilities. Alaska currently has 5,099 dedicated beds for seniors. Of these, 2,086 beds are in assisted living facilities.[23] Nationally, seniors make up 14.9 percent of the population and an estimated 3.5 percent received care in a dedicated facility.[24]

Analysis found that the number of senior citizens per senior facility bed in each region varies widely, with Calista having the highest number of seniors per licensed facility bed at approximately 43 (Fig. 6). This is nearly three times as high as the statewide average of 15

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[20] U.S. Census Bureau. (2016). *American Community Survey, 2010–2014 American Community Survey Five-year Estimates*. Retrieved from http://factfinder2.census.gov

[21] Seniors are defined as individuals 65 years old or older.

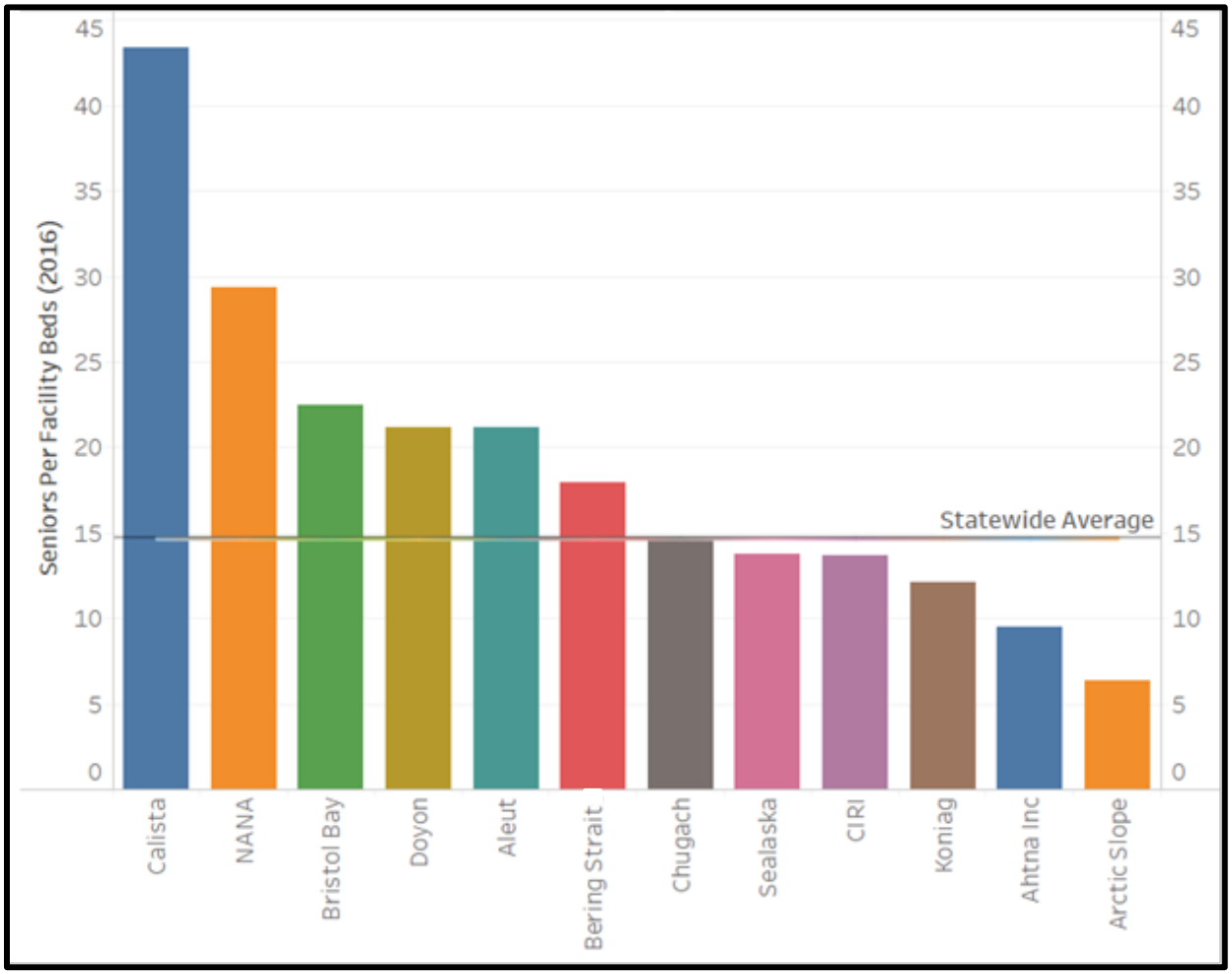
[22] Hunsinger, Eddie, Sandberg, E., & Brooks, L. (2016). *Alaska Population Projections 2015 to 2045*. Alaska Department of Labor and Workforce Development, Research and Analysis Section.

[23] AHFC Senior Housing Office. (2016). *Inventory List: Assisted Living Homes / Facilities*. Revised 5/02/2016. AHFC Senior Housing Office. (2016). *Inventory List: Independent Living Homes / Facilities* Revised 5/02/2016. Retrieved from https://www.ahfc.us/senior-support/

[24] Ribbe, M., Ljunggren, G., Steel, K., Topinkova, E., Hawes, C., Ikegami, N., Henrard J.C., & Jonnson, P. (1997). "Nursing homes in 10 nations: a comparison between countries and settings." *Age Ageing 26(Suppl. 2):3–12*.

seniors per bed. The Arctic Slope region currently has the fewest seniors per licensed facility bed at 6 per bed.

Figure 6: Number of senior citizens per senior facility bed

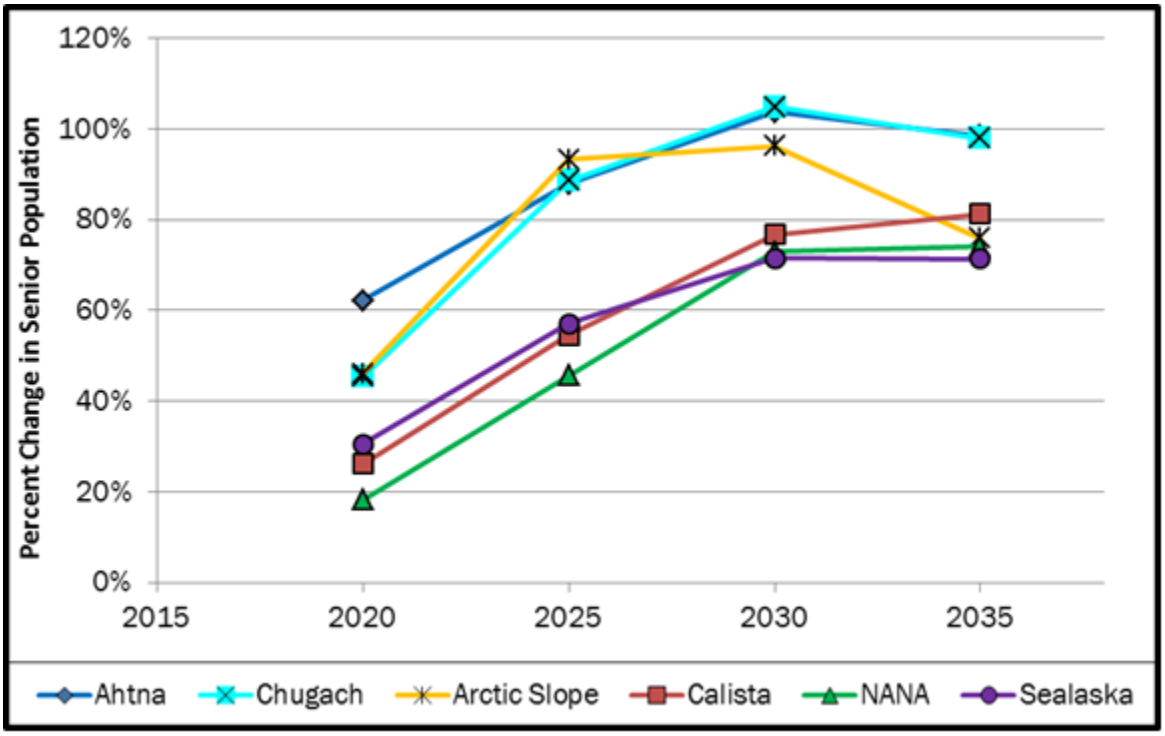


Even in areas of Alaska with more independent and assisted-living facility beds per senior, such as Sealaska and CIRI regions, senior citizens reported a shortage of senior housing. Public elder listening sessions were held in Anchorage, Fairbanks, Juneau, Kenai Peninsula and Copper Center as a part of the data collection for the *Alaska Senior Needs Assessment*, and all of these regions reported a shortage of either affordable independent senior housing facilities or assisted living facilities.[25] The researchers also surveyed more than 2,000 senior citizens and found that affordable and accessible housing was the third most important issue for them, closely behind health care and financial security.

[25] Denali Daniels & Associates. (2015). *Needs Assessment Report: Alaska State Plan for Senior Services: FY 2016–2019*. Retrieved from http://dhss.alaska.gov/acoa/Documents/minutes/ACoA_NeedsAssessmentReport.pdf

Fig. 7 shows projected percentage changes for the top and bottom three ANCSA regions. Ahtna, Chugach and Arctic Slope regions are expected to see greatest percentage increase in senior age populations by 2030. Calista, NANA and Sealaska are expected to see smallest percentage change in senior age population by 2030. Sealaska is the ANCSA region with slowest expected growth, yet it is still expected to have its senior population grow by more than 71 percent by 2030. This represents approximately 6,943 people older than age of 65.[26]

Figure 7: Projected changes in senior population by select ANCSA region



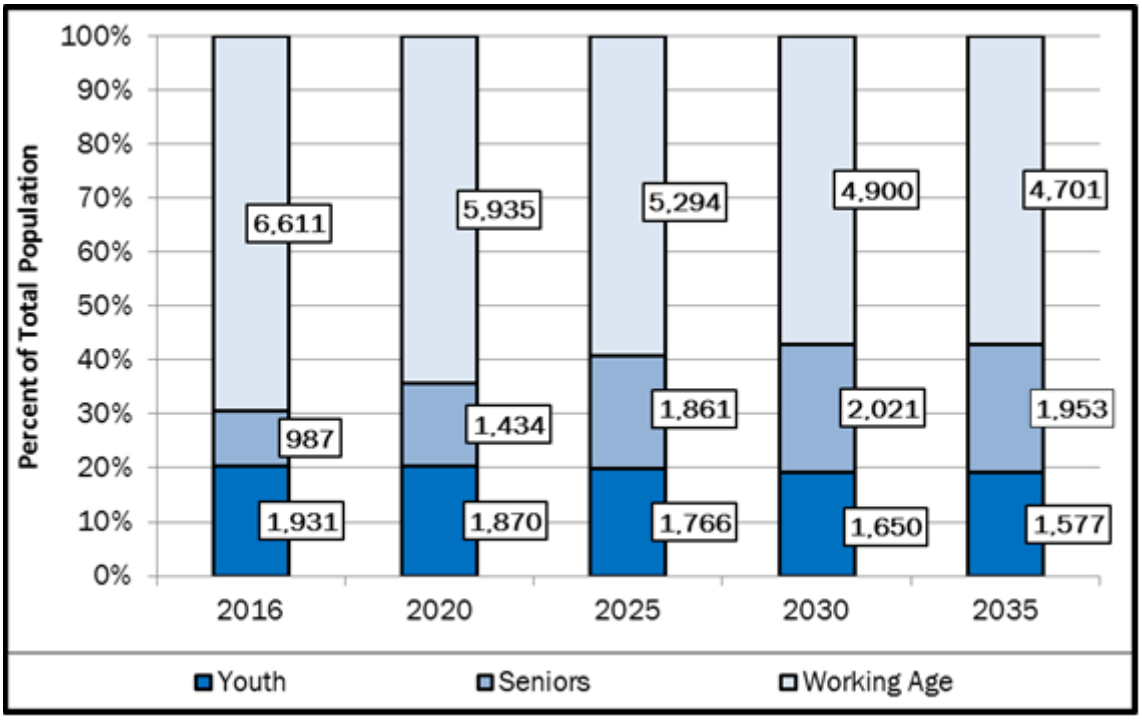
Currently, elder listening sessions have identified an unmet need for senior housing facilities.[27] With the Alaska state demographer projecting a rapidly growing senior population, significant amounts of senior housing facility beds will need to be built or converted.[28] To simply maintain the current ratio of senior housing beds to senior citizens in Alaska, an estimated 4,450 new beds will need to be built or converted by 2030, or approximately 318

[26] Estimates and projections from the Alaska state demographer use trends from past birth and death rates as well as expected net migration into and out of an area.
[27] Denali Daniels & Associates. (2015). *Needs Assessment Report: Alaska State Plan for Senior Services: FY 2016–2019*. Retrieved from http://dhss.alaska.gov/acoa/Documents/minutes/ACoA_NeedsAssessmentReport.pdf
[28] Hunsinger, Eddie, Sandberg, E., & Brooks, L. (2016). *Alaska Population Projections 2015 to 2045*. Alaska Department of Labor and Workforce Development, Research and Analysis Section.

per year.[29] This represents both a significant challenge for the state to meet needs of the growing senior population as well as an opportunity for businesses in this sector.

Some regions are expected to face a decrease in population of working age people during the same period as the increase in senior population. These regions include Ahtna, Aleut, Bristol Bay, Chugach, Koniag and Sealaska. The Chugach region is projected to have the largest decline (on a percentage basis) in its working age population (Fig. 8). Overall, Alaska's senior population is projected to grow at a rate several times that of the youth population, with some of the highest growth rates found in regions such as Ahtna, Aleut, Arctic Slope and Chugach.

Figure 8: Chugach region population projections

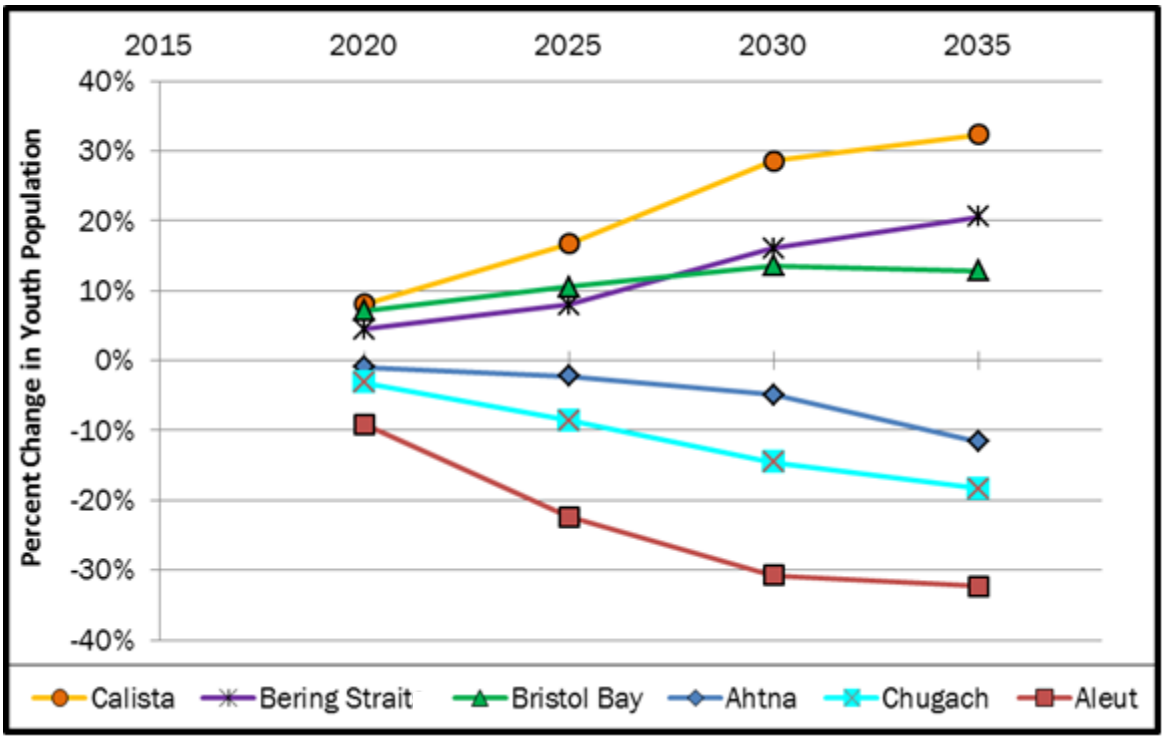


[29] Estimates based on Alaska Department of Labor senior population growth estimates and AHFC senior housing database.

Households with Young Dependents

For purposes of this report, definitions for the youth dependency ratio were used, where young dependents refers to children younger than the age of 16, when they can enter the workforce. Households with young dependents are projected to have population increases in some areas of the state. Demand for new housing from such households is expected to be less than that of households with seniors. Regions of Ahtna, Aleut, Chugach, and to a lesser extent Sealaska are expected to see decreases in youth populations. The highest youth growth rates are projected for Arctic Slope, Bering Straits, Bristol Bay and Calista.

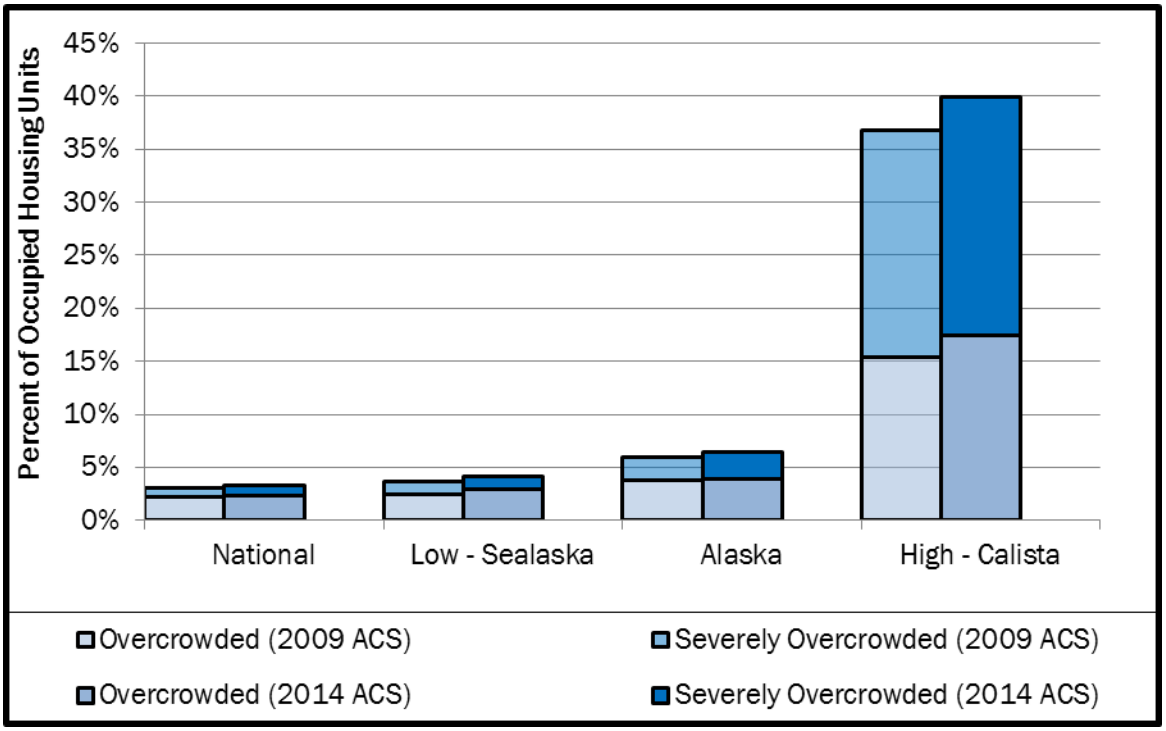
Figure 9: Projected changes in youth population by select ANCSA region



Overcrowding

For purposes of defining "overcrowding," this report uses U.S. Department of Housing and Urban Development's (HUD) criteria. An "overcrowded" home is defined as having more than one person per room, and a "severely overcrowded" home as having more than 1.5 people per room. In this case, "rooms" are any spaces separated by a partial or complete wall, including kitchens, living rooms, dining rooms, bedrooms, etc., but not including bathrooms, porches, balconies, foyers, halls or unfinished basements. This HUD definition is based on the level at which health and childhood education begin to suffer because of crowded conditions.[30, 31]

Figure 10: Percent of overcrowded housing in Alaska vs. national estimates



In Alaska, overcrowding is twice as high as the national average (Fig. 10). The least overcrowded ANCSA region, Sealaska, has a higher overcrowding rate than the national average and the most overcrowded region, Calista, has an overcrowding rate more than 12 times the national average. While the majority of ANCSA regions have higher overcrowding

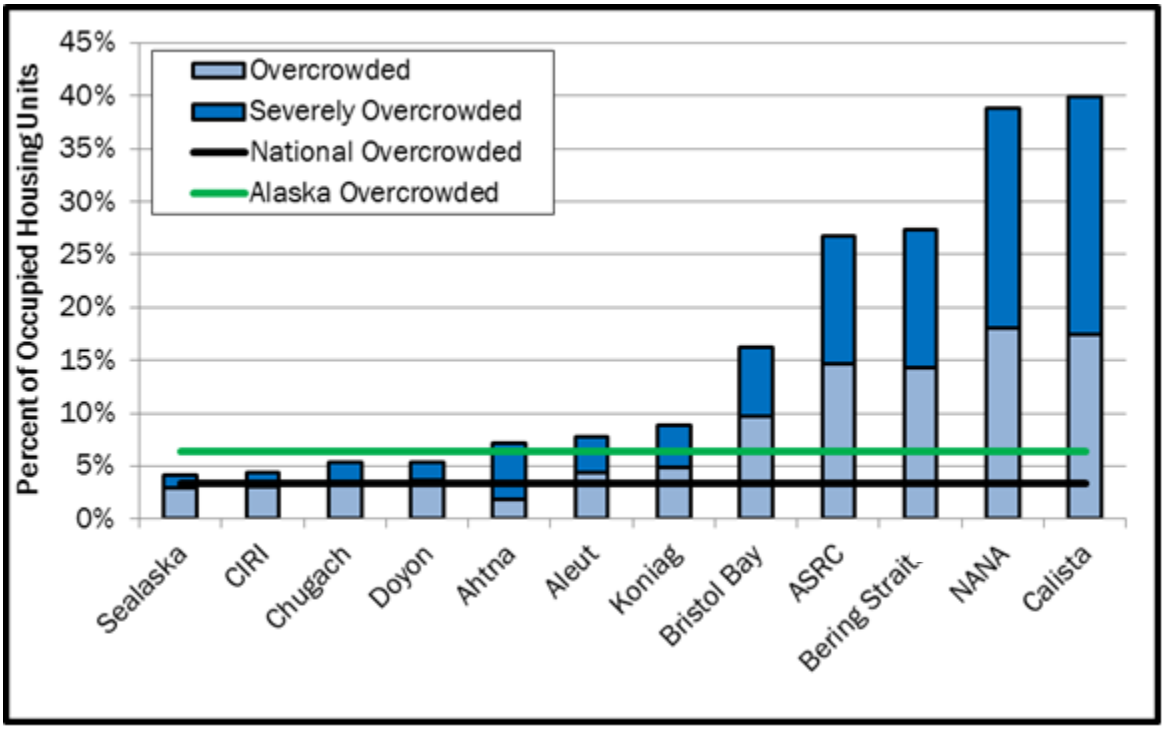
[30] Blake, K., Kellerson, R., & Simic, A. (2007). *Measuring Overcrowding in Housing*. U.S. Department of Housing and Urban Development Office of Policy Development and Research. Retrieved from http://www.huduser.org/publications/pdf/measuring_overcrowding_in_hsg.pdf

[31] The United Kingdom Office of the Deputy Prime Minister. (2004). *The Impact of Overcrowding on Health & Education: A Review of Evidence and Literature*. Office of the Deputy Prime Minister Publications. Retrieved from http://dera.ioe.ac.uk/5073/1/138631.pdf

estimates than the previous five-year period, analysis showed these changes to not be statistically significant.

Some areas in Alaska exhibit significantly higher rates of overcrowding than others (Fig. 11). Three of the lowest rates of overcrowding are found in regions that include Alaska's largest population centers: Sealaska, CIRI and Doyon.

Figure 11: Overcrowding by ANCSA region



Overcrowding can be driven by several factors. Three common factors are a lack of housing due to the high cost to build, a lack of affordable housing, or a lack of available land with access to utility connections for new housing units.

Many rural regions of Alaska face high costs to build housing, often beyond what local residents could afford to pay. Contractors do not build in those regions, leaving it to housing authorities. Since housing authorities rely heavily on state and federal funds to build new housing, new housing construction is often slower than demand. Housing built by housing authorities is often conveyed to new owners at a value less than that needed to construct the home. The slow pace of construction often leads to extended families sharing a housing unit. Even in rural areas where housing is available, high costs associated with fuel, rent and other housing costs can lead extended families to share a housing unit because nuclear families cannot support homes on their own.

Urban Alaska, especially in Anchorage, has limited land available for new construction.[32] Therefore households make the choice to share homes or purchase homes in a nearby community.

In contrast, rates of overcrowding are significantly higher in western and northern Alaska. Both the Arctic Slope and Bering Straits regions have more than six times the overcrowding rates found in Sealaska and CIRI. NANA and Calista regions have nearly nine times the overcrowding found in these population centers. Both NANA and Calista regions have very high rates of overcrowding, with an estimated 39 percent and 40 percent, respectively. This translates to approximately 779 overcrowded housing units in NANA and 2,446 in Calista.

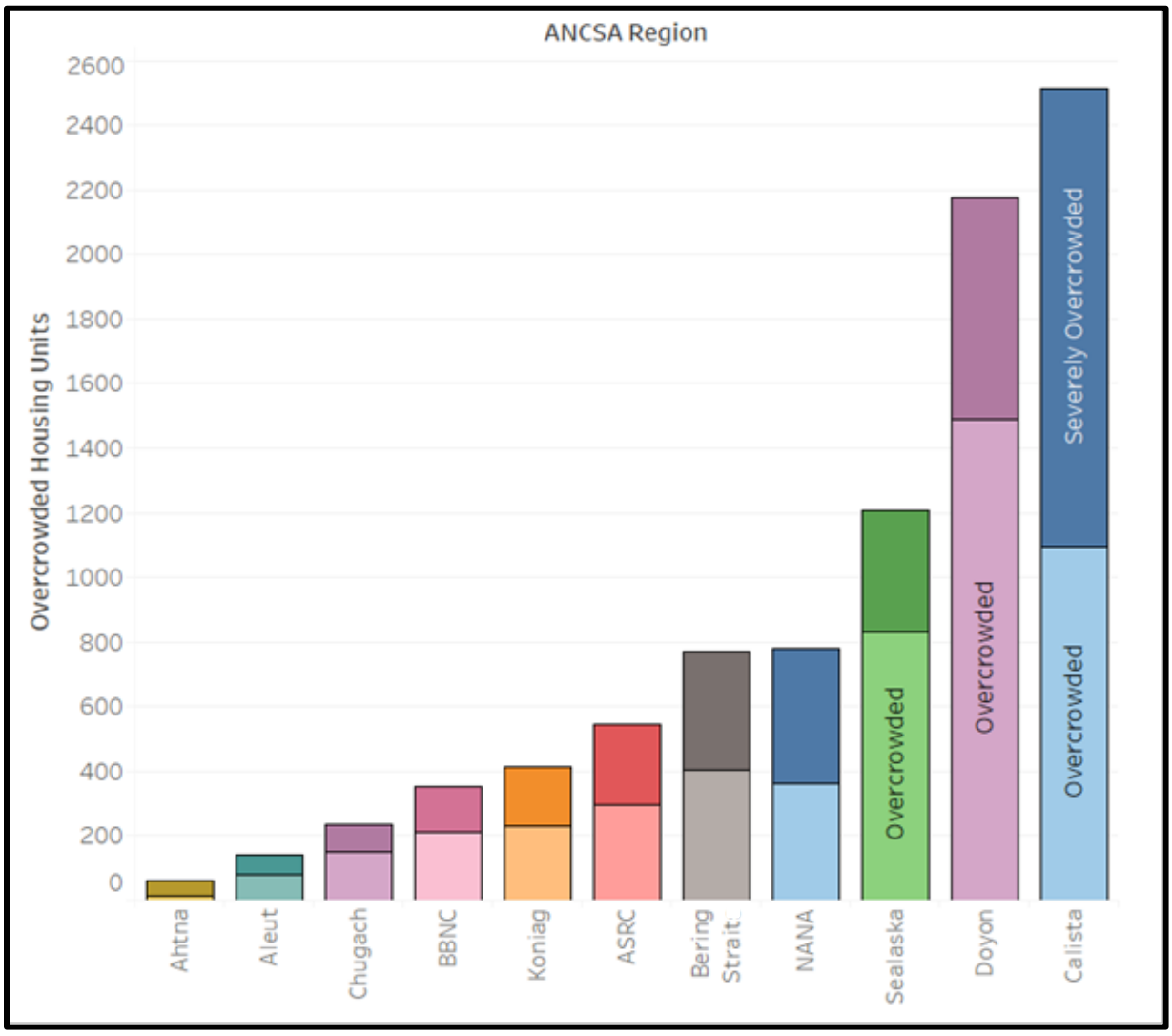
The national Assessment of American Indian, Alaska Native and Hawaiian Housing Needs found that overcrowding was the manifestation of a homelessness problem in tribal housing across the nation.[33] These cultures typically support taking in family and community members who need a place to stay. While many interviewees reported having household members who were only there because they had no place to go, very few reported that they would ever ask them to leave. However, 80 percent of interviewees believed extra household members would like to move to their own housing unit if they could. People interviewed included many Alaskans, and so the high rates of overcrowding in rural Alaska are also likely a result of homelessness.

[32] *McDowell Group and ECONorthwest for Municipality of Anchorage. (2012). Anchorage Housing Market Analysis.* Retrieved from https://www.muni.org/Departments/OCPD/Planning/Publications/Documents/Anchorage%20Housing%20Market%20Analysis%20Summary%20Report.pdf

[33] U.S. Department of Housing and Urban Development, Office of Policy Development and Research. (2017). *Housing Needs of American Indians and Alaska Natives in Tribal Areas: A Report From the Assessment of American Indian, Alaska Native, and Native Hawaiian Housing Needs*. Retrieved from https://www.huduser.gov/portal/native_american_assessment/home.html

New housing units are needed to alleviate overcrowded housing conditions. Overcrowding rates in rural Alaska are higher than in urban Alaska, with overcrowding affecting up to 50 percent of households, but total overcrowded units is highest in the CIRI region (approximately 6,860 units) because of its much larger population. Fig. 12 shows total number of overcrowded and severely overcrowded units in the remaining ANCSA regions. Conservatively assuming that one new housing unit would need to be built to alleviate overcrowded conditions in one existing unit, statewide an estimated minimum of 16,107 units would need to be built to fully alleviate overcrowding in Alaska.

Figure 12: Overcrowding gap by ANCSA region



Overcrowding Versus Vacancy Rates

Comparison of overcrowding and vacancy rates allows for additional context regarding overcrowding (Fig. 13). For purposes of comparison, the 2014 ACS overcrowding rates have been recalculated from percent of occupied housing units to percent of total housing units. Vacant units in this comparison are units identified in the 2014 ACS as either vacant, for sale or vacant, for rent. Calista is the ANCSA region with the highest rates of overcrowding. Note the rate of overcrowding is more than 13 times the vacancy rate in Calista. This highlights that one factor of overcrowding in Calista is lack of available housing.

Figure 13: Percent of overcrowded and vacant housing in Alaska vs. national estimates

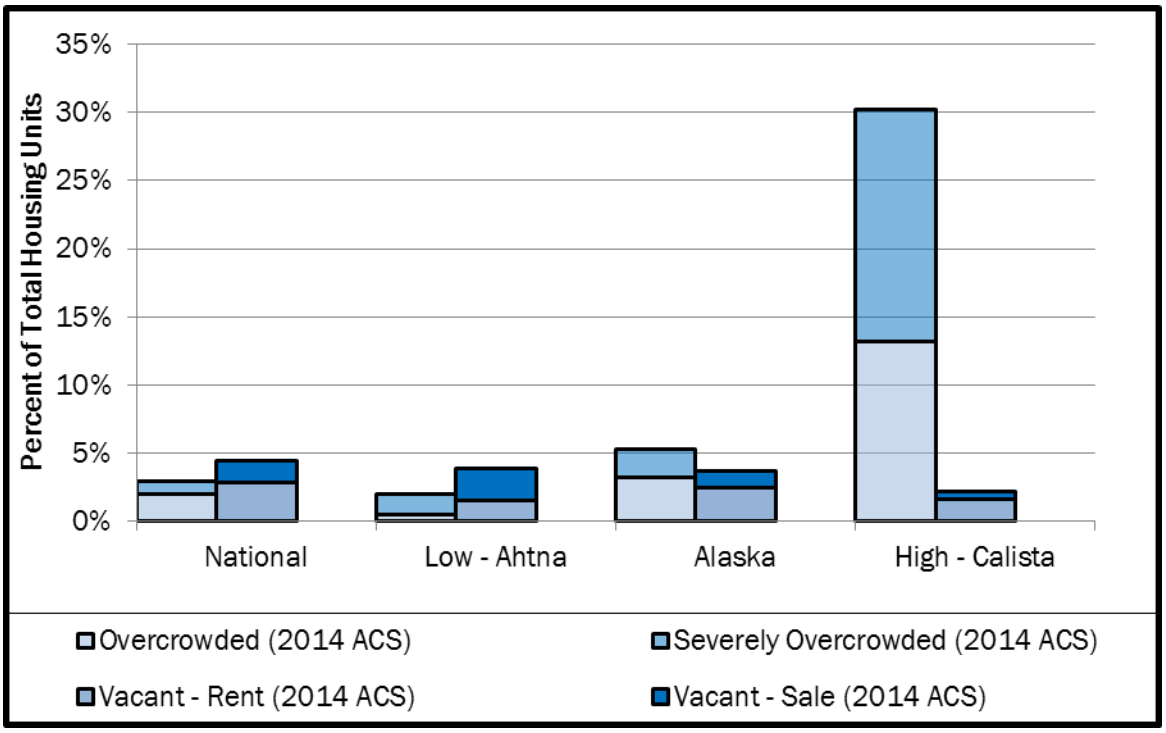
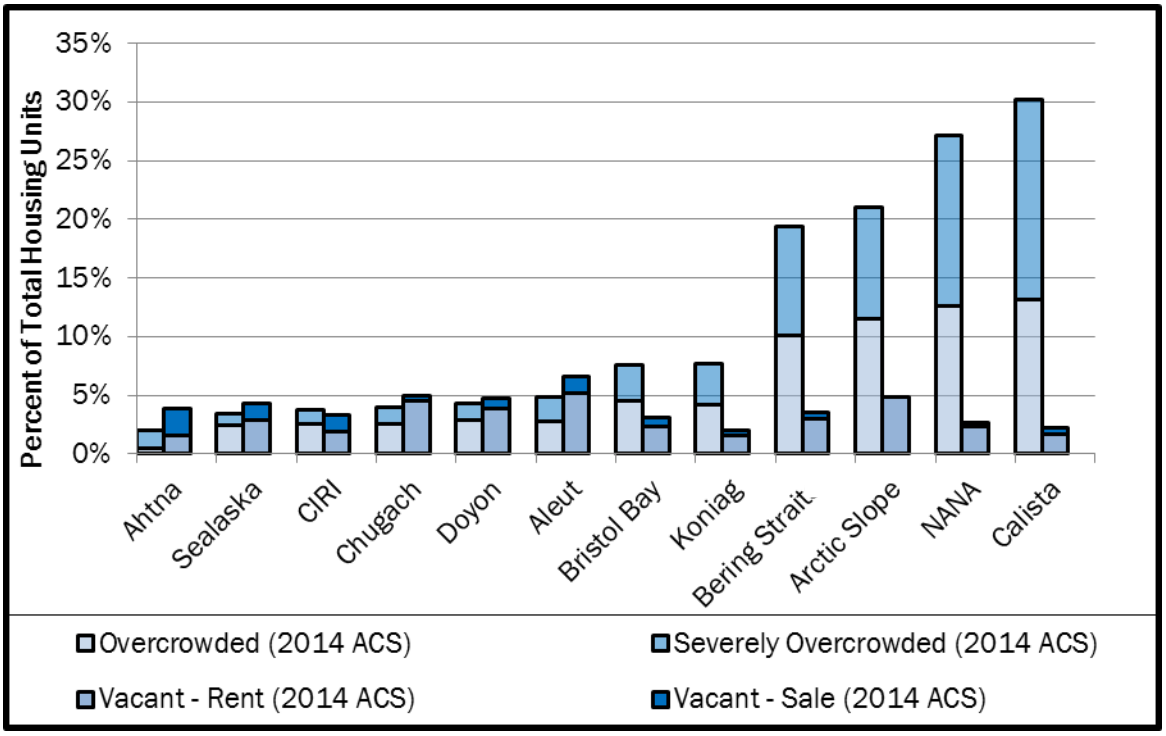


Fig. 14 compares overcrowding rates and vacancy rates for ANCSA regions. Note that all western and northern coastal regions have overcrowding rates that exceed their vacancy rates. These range from Bristol Bay with an overcrowding rate twice that of its vacancy rate to Calista with an overcrowding rate 13.6 times its vacancy rate.

Figure 14: Overcrowding vs. vacancy by ANCSA region

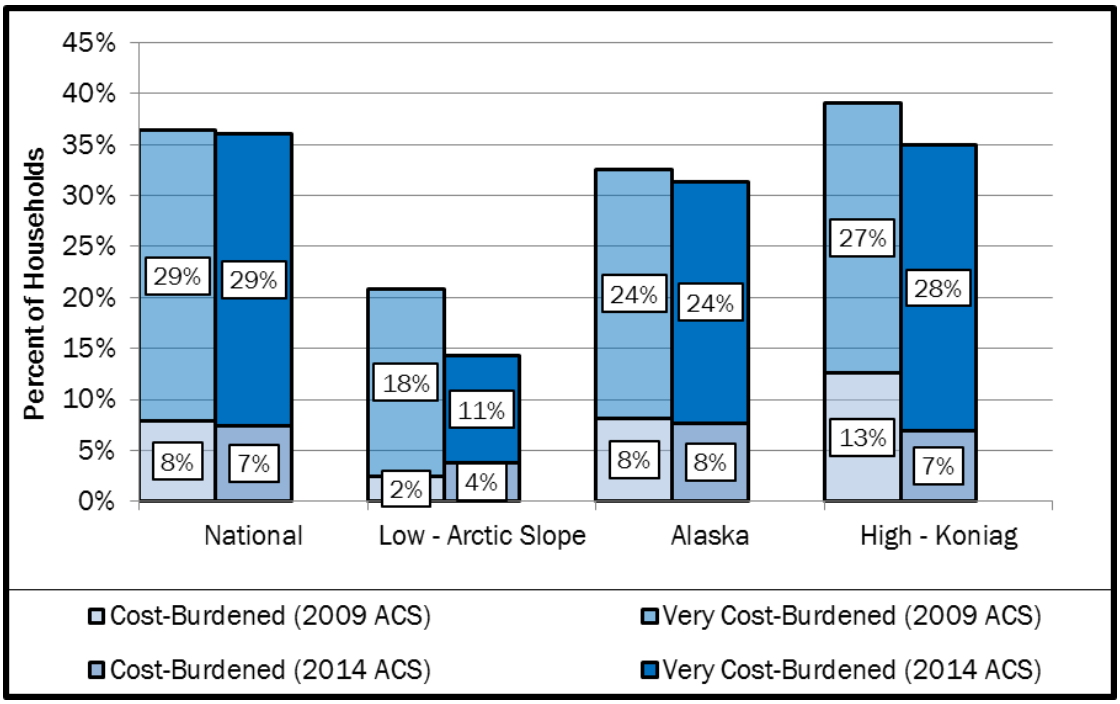


Affordability

U.S. Department of Housing and Urban Development (HUD) considers households "cost-burdened" if they are spending more than 30 percent of their income on total housing costs, “very cost-burdened” if they are spending more than 35 percent of their income, and "severely cost-burdened" if they are spending more than 50 percent of their income on housing. These housing costs include rent/mortgage, insurance, taxes, energy, utilities and any applicable subsidies. Household income includes all income received by household members, including investments and public assistance.[34] Data on severely cost-burdened households are not available on a regional level. This report focuses on cost-burdened and very cost-burdened both metrics are tracked in U.S. Census’ American Community Survey data.

Nationwide, approximately 37 percent of housing units are considered cost-burdened (Fig. 15). Statewide approximately 32 percent of housing units are cost-burdened, with highest rates found in the CIRI region (34 percent) and lowest rates found in the Arctic Slope region (13 percent). Roughly one in three Alaska households are potentially unable to afford basic necessities because of high housing costs.

Figure 15: Percent cost-burdened housing in Alaska vs. nationwide

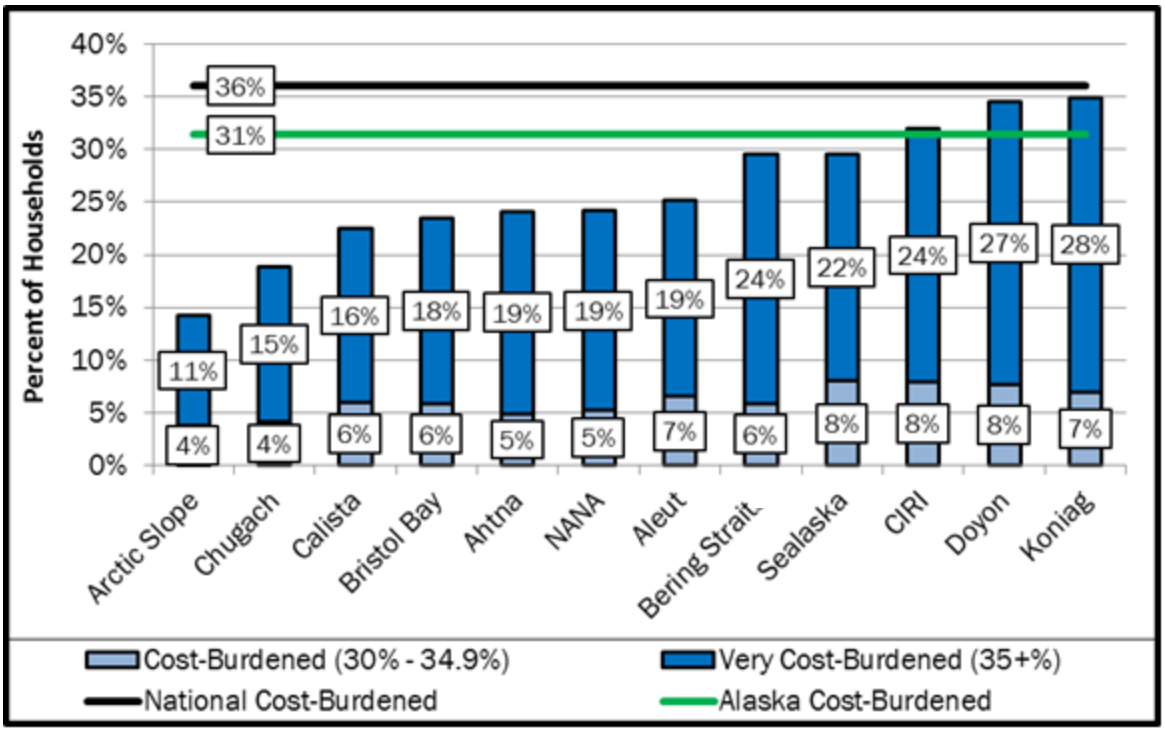


[34] U.S. Census Bureau. (2016). *American Community Survey and Puerto Rico Community Survey: 2014 Subject Definitions*. Retrieved from https://www2.census.gov/programs-surveys/acs/tech_docs/subject_definitions/2014_ACSSubjectDefinitions.pdf

ACS estimates are the most comprehensive data available for cost-burdened housing. Previous research found that these energy costs were being underestimated outside of urban areas; however, current analysis suggests this problem has been fixed, and lower-than-expected cost-burdening rates in some areas are due to public assistance funds not being accounted for in survey data. For more information about the analysis of ACS energy costs, see Appendix A: Energy Cost Analysis.

According to ACS estimates, the percentage of cost-burdened households varies from very high to very low within Alaska (Fig. 16). The Koniag region has the highest percentage of cost-burdened and very cost-burdened households among ANCSA regions. It is joined by Sealaska, CIRI and Doyon regions in having more than one-third of households that pay 30 percent or more of household income for housing costs. These regions are among the most urban regions in Alaska, suggesting that areas with dense urban populations have less affordable housing. In contrast, the rural Calista region has an unemployment rate among the highest in the state, as well as one of the lowest median incomes, and yet it is the third most affordable ANCSA region.[35] This may be due in part to ACS housing cost estimates include public assistance funds, such as low-income heating assistance, subsidized rents and lease-to-own contracts that lower housing costs.

Figure 16: Percent of cost-burdened households by ANCSA region

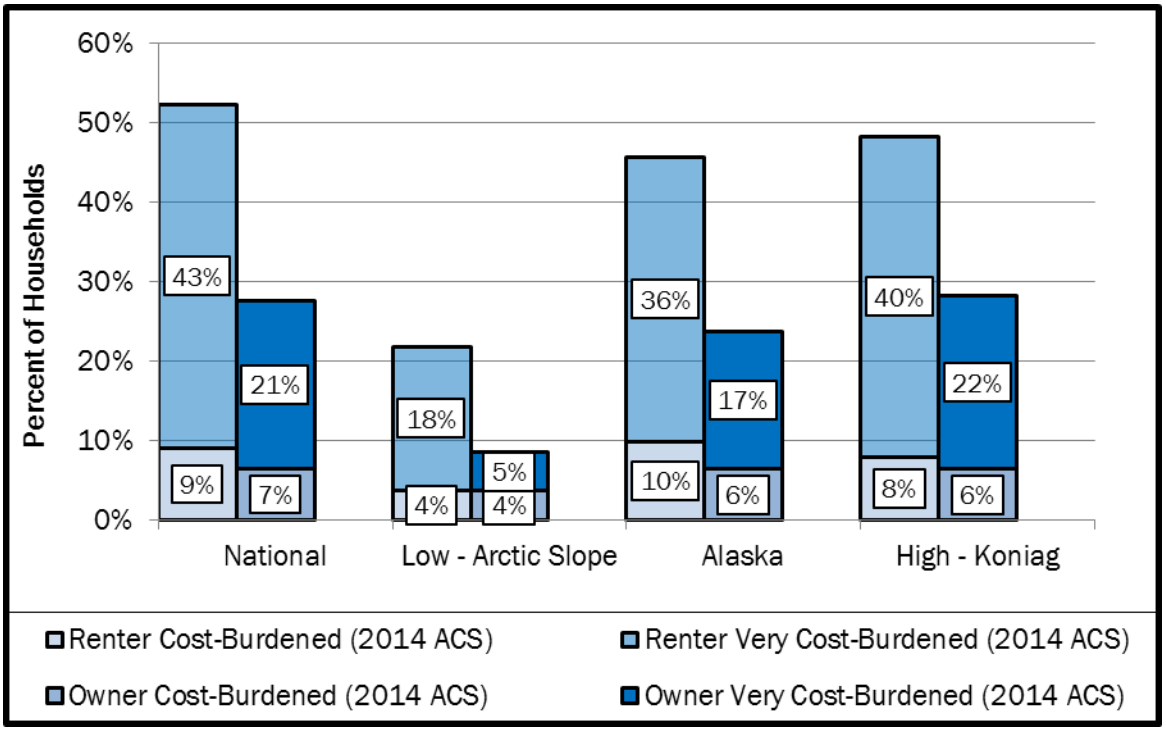


[35] Alaska Department of Labor and Workforce Development, Research & Analysis Section. (2017). *April 2017 Unemployment Rate, Not Seasonally Adjusted*. Retrieved from http://laborstats.alaska.gov/

Cost-Burdened Owner-Occupied vs. Renter Occupied

Breaking down cost-burdened and very cost-burdened rates into categories of owner-occupied and renter-occupied shows that renters bear a higher percentage of cost burden. Both in Alaska and nationally, the renter-occupied cost-burdened rate is nearly twice the owner-occupied cost-burdened rate.

Figure 17: Percent cost-burdened housing (owner- and renter-occupied) in Alaska vs. nationwide



Median Household Income, Unemployment and Poverty

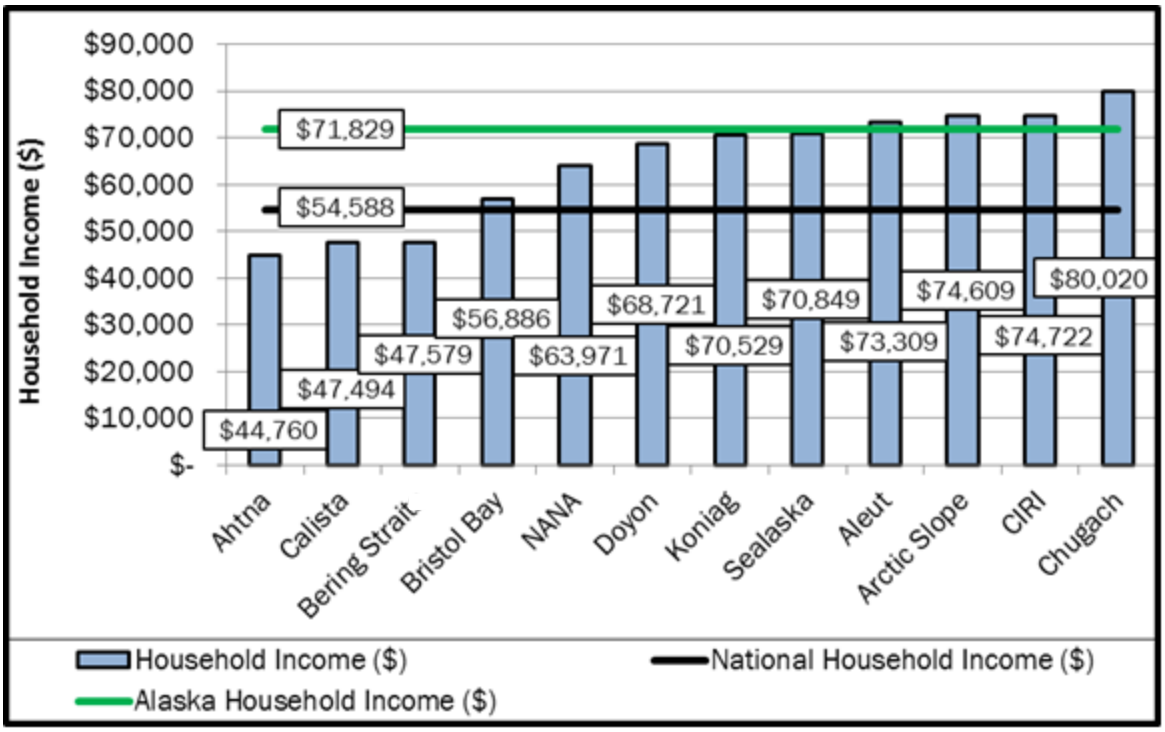
Metrics of median household income, total unemployment rate and poverty rate provide a deeper look at affordability and give additional depth to an examination of cost-burdened households.[36], [37] Regions with highest median household incomes also have lowest unemployment and lowest poverty.

The poorest households face the biggest gap in available affordable housing. Households are considered extremely low income if their income is at or below poverty level, or below 30 percent of the area median income (AMI). In Alaska, these extremely low-income households make up the majority (67 percent) of severely cost-burdened households.[38, 39] The high cost burden of housing for these families increases likelihood of living in substandard housing, increases their risk of eviction and leads to lower spending on basic necessities like healthcare and food.[40] In fact, low-income households that are severely housing cost-burdened on average spend 74 percent less on healthcare and 41 percent less on food than low-income households that live in affordable housing.[41] According to National Low Income Housing Coalition's estimates, Alaska has a shortage of 15,972 affordable and available housing units for extremely low-income households.[42]

[36] Total unemployment rate is the percentage of total population that is unemployed, rather than those who have filed for unemployment while looking for a job.
[37] Poverty rate is the percentage of the population that is below the poverty line, or below the estimated minimum level of income needed to secure the necessities of life.
[38] "Severe cost burden" is defined by HUD as spending more than 50% of total household income on housing costs.
[39] Aurand, A., Emmanuel, D., Crowley, S., Errico, E. Leong, G. M., & Rodrigues, K. (2016). *The GAP: Affordable Housing Gap Analysis 2016.* National Low Income Housing Coalition. Retrieved from http://nlihc.org/sites/default/files/Gap-Report_2016.pdf
[40] Joint Center for Housing Studies of Harvard University. (2016). *State of the Nation's Housing 2016*. Retrieved from http://www.jchs.harvard.edu/sites/jchs.harvard.edu/files/jchs_2016_state_of_the_nations_housing_lowres.pdf
[41] Ibid.
[42] Yentel, D., Aurand, A., Emmanuel, D., Errico, E., Leong, G. M., & Rodrigues, K. (2016). *Out of Reach 2016*. National Low Income Housing Coalition. Retrieved from http://nlihc.org/sites/default/files/oor/OOR_2016.pdf

Fig. 18 shows that three of Alaska's rural ANCSA regions have median household incomes below the national median and 60 to 66 percent of statewide household median income. These three regions, Ahtna, Calista and Bering Straits, have the highest levels of total unemployment and poverty.

Figure 18: Median household income by ANCSA region

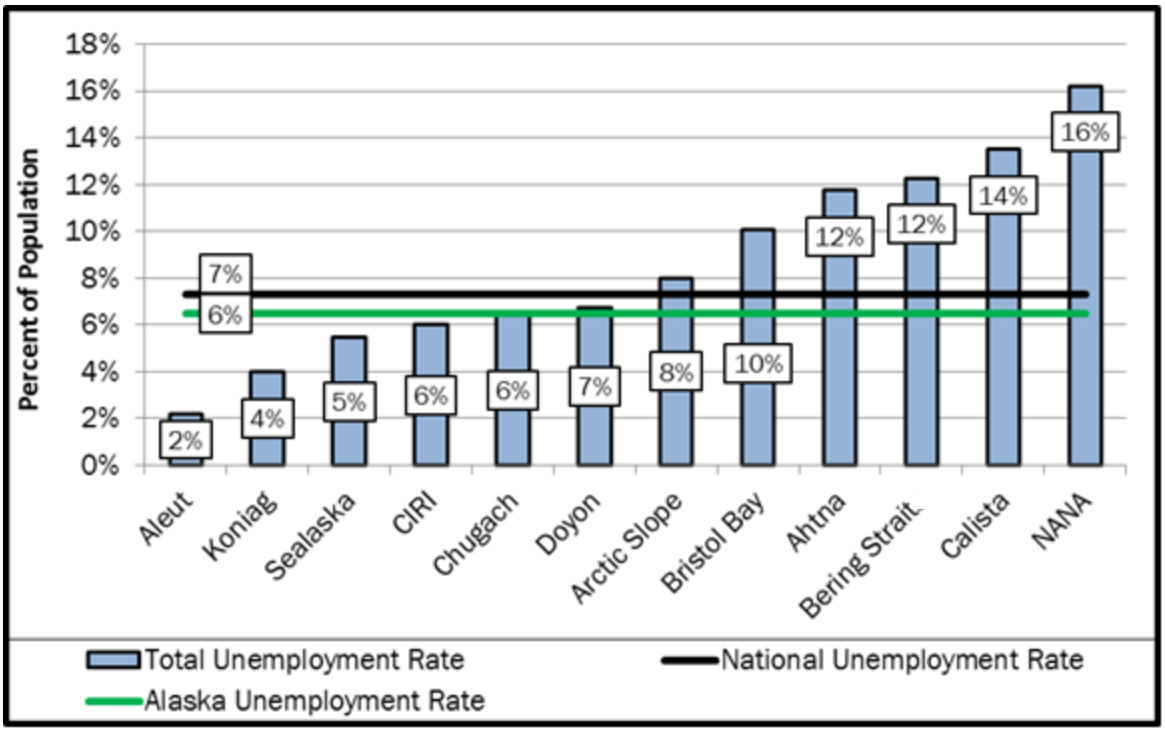


Several factors influence the rate of cost-burdened housing, including higher property values in some urban areas that can drive up housing prices, public subsidies to make housing more affordable and historic underestimation of energy costs in rural Alaska within American Community Survey data.[43] Energy costs in rural Alaska often make up a significant part of a household's monthly housing costs.

[43] WH Pacific. (2015). *North Slope Borough Regional Energy Plan*. Retrieved from http://www.north-slope.org/assets/images/uploads/Feb2015_draft_NSB_Energy_Plan_2.6.15.pdf

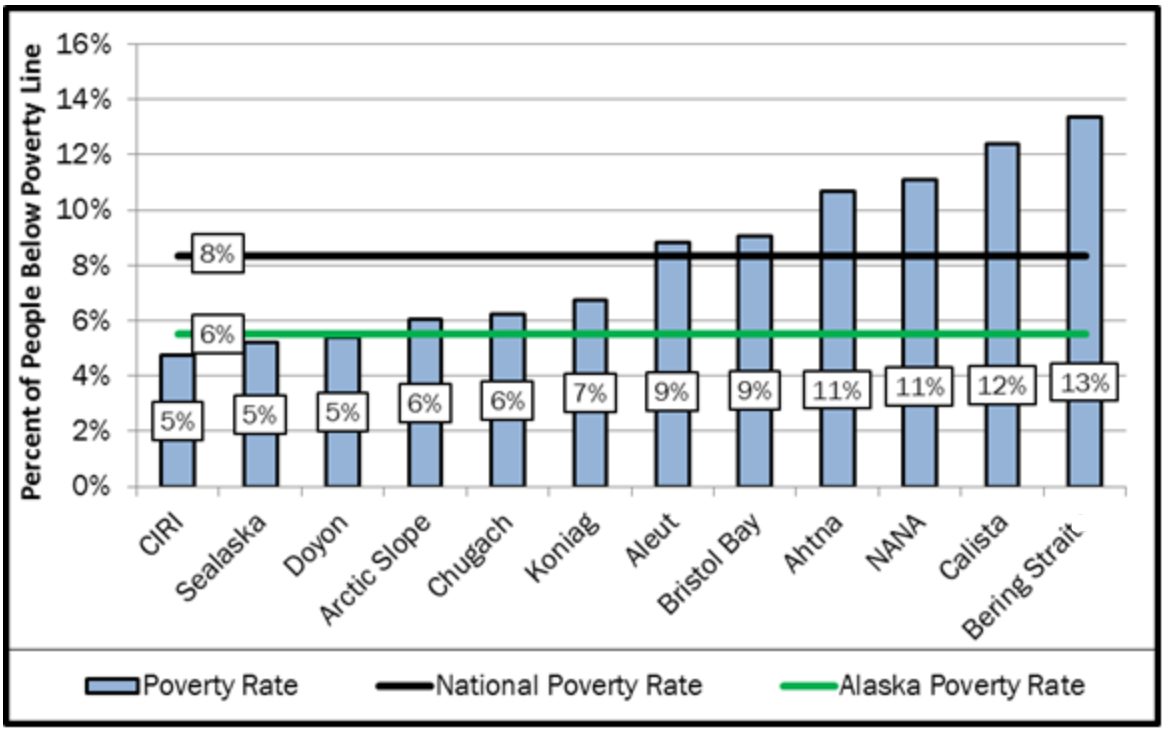
The NANA region, which has the highest rate of total unemployment (16 percent) and a rate that is more than twice the state or national average (6 percent and 7 percent respectively), also has the fifth lowest median household income ($63,971). The poverty rate (11 percent) is almost twice the statewide average (6 percent). The lowest total unemployment rate is found in the Aleut region.

Figure 19: Total unemployment rate (%) by ANCSA region



Bering Straits and Calista have poverty rates that are more than twice the statewide average and at least 1.5 times the national average. Both regions have total unemployment rates twice the statewide average and nearly twice the national average. Their median household incomes are two of the lowest.

Figure 20: Poverty rate (%) by ANCSA region



According to National Low Income Housing Coalition, the average wage of a single-income household needed to afford a two-bedroom rental apartment in Alaska is $23.25 per hour, which is the ninth highest in the U.S. This varies regionally, with Aleutians West Borough highest at $28.90 per hour.[44] It is important to consider the area median income when looking at affordability, as regions where housing costs require a high wage may still be affordable for many households if local incomes are commensurate. When comparing regional housing costs to incomes, the two least affordable regions in Alaska are Nome and Bethel census areas, where income needed to afford a two-bedroom unit at the fair market rent represents 114 percent and 100 percent of area median incomes, respectively.[45] For example, in the Nome census area, a household would need to earn $55,040 per year, which would be 114 percent of AMI, in order to spend less than 30 percent of their annual income

[44] https://ahfc.us/efficiency/research-information-center/alaska-housing-assessment/2018-housing-assessment/
[45] Yentel, D., Aurand, A., Emmanuel, D., Errico, E., Leong, G. M., & Rodrigues, K. (2016). *Out of Reach 2016*. National Low Income Housing Coalition. Retrieved from http://nlihc.org/sites/default/files/oor/OOR_2016.pdf

on housing costs for a two-bedroom rental unit. For more details see the data profiles available on AHFC's website.[46]

[46] https://ahfc.us/efficiency/research-information-center/alaska-housing-assessment/2018-housing-assessment/

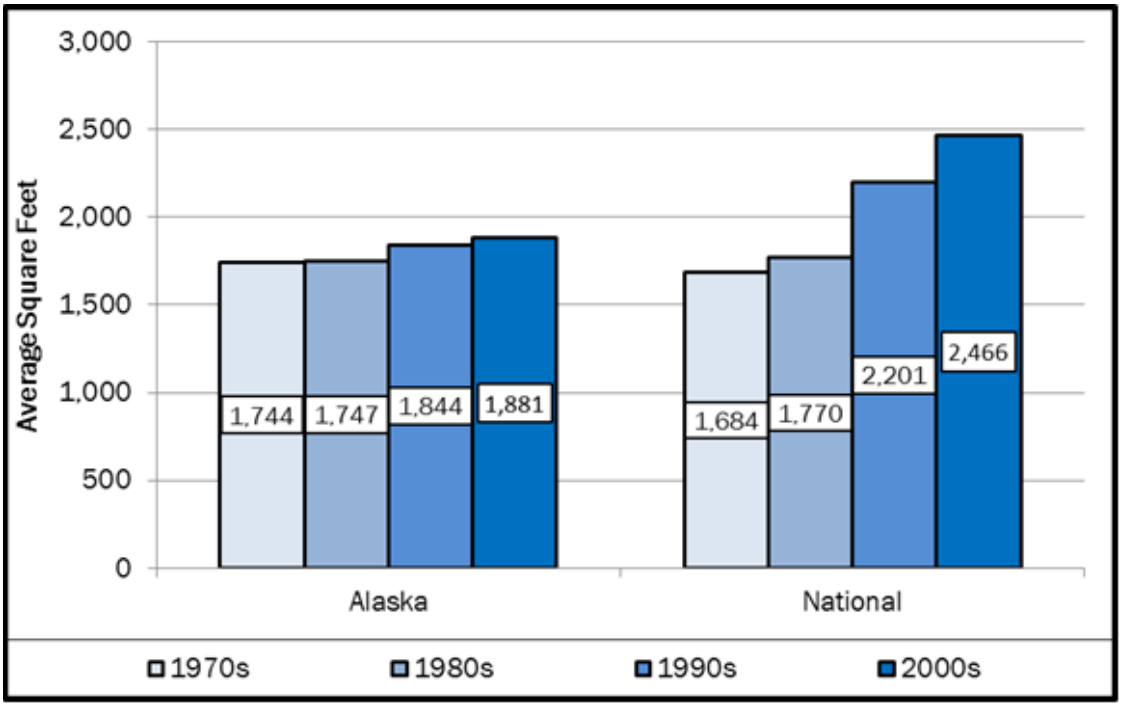
Energy

Data on both energy use and costs are useful for characterizing housing need. This data shows that energy costs in Alaska are higher on average than national costs and contribute to elevated cost of housing. This data also allows for regional comparisons, showing that the highest energy cost burden is found in western coastal and interior Alaska. This is likely due to a combination of colder climates, higher heating prices and, in some cases, less efficient homes. As noted previously, Alaska-specific information in this section is derived from data in AHFC's ARIS database.[47]

Trends in Home Size

The average house size in Alaska differs from the national average (Fig. 21). While average home sizes were similar in the 1970s, the U.S. average has increased each decade since, outpacing more modest increases found in Alaska. For homes built in the 2000s, the average building size in the United States is estimated by RECS to be 2,466 sq. ft.[48] This is 585 sq. ft. larger than the average home size in Alaska of 1,881 sq. ft., estimated using ARIS data.

Figure 21: Trends in building size by year built



[47] See Appendix C: Selected Methodology for details.
[48] U.S. Energy Information Administration, Independent Statistics and Analysis. (2016). *Residential Energy Consumption Survey (RECS) 2009*. Retrieved from https://www.eia.gov/consumption/residential/data/2009/index.php

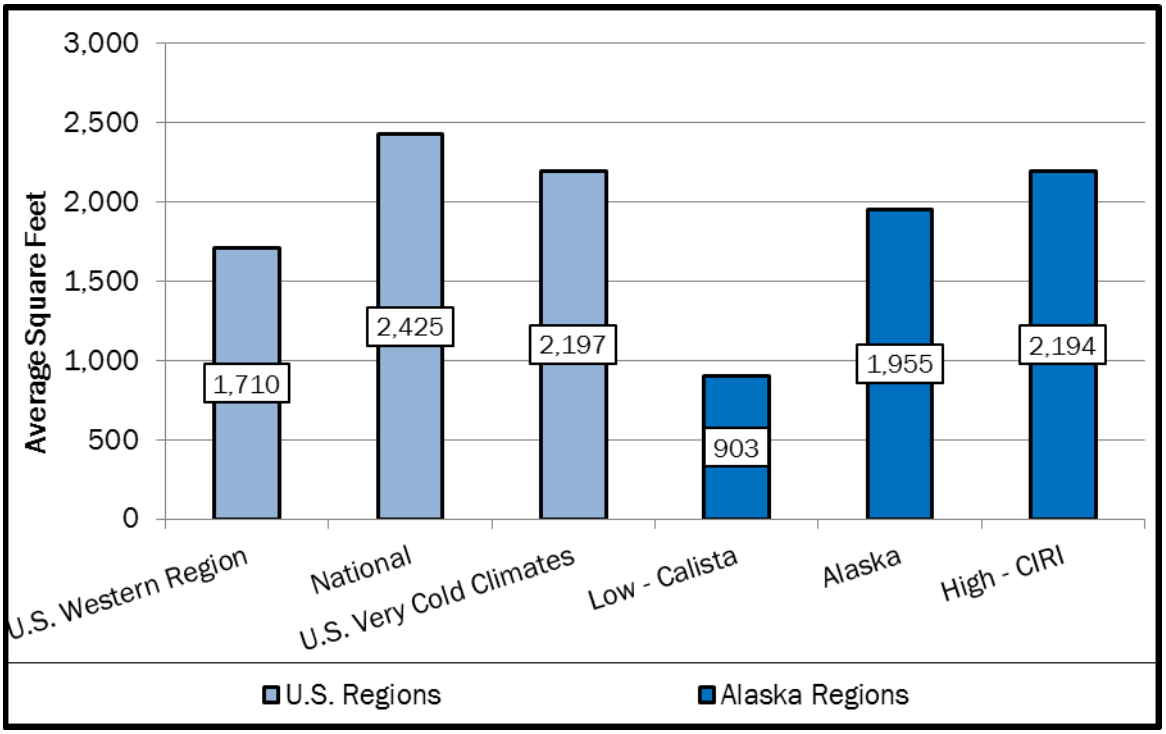
Single-Family Units

According to ACS estimates, approximately 72 percent of households live in single-family housing units. Per U.S. Census Bureau, "a housing unit is a house, an apartment, a group of rooms, or a single room occupied or intended for occupancy as separate living quarters. Separate living quarters are those in which occupants do not live and eat with other persons and which have direct access from outside the building or through a common hall." For purposes of this report, housing units are further divided into single-family units and multifamily units. A single-family unit is defined as a dwelling for a single household. These can be mobile homes, homes with no garage or homes with an attached or detached garage but not duplexes, triplexes or homes with an apartment.

House Size

Single-family housing units in Alaska are smaller than the national average (Fig. 22).

Figure 22: Average single-family home size in Alaska vs. national RECS estimates

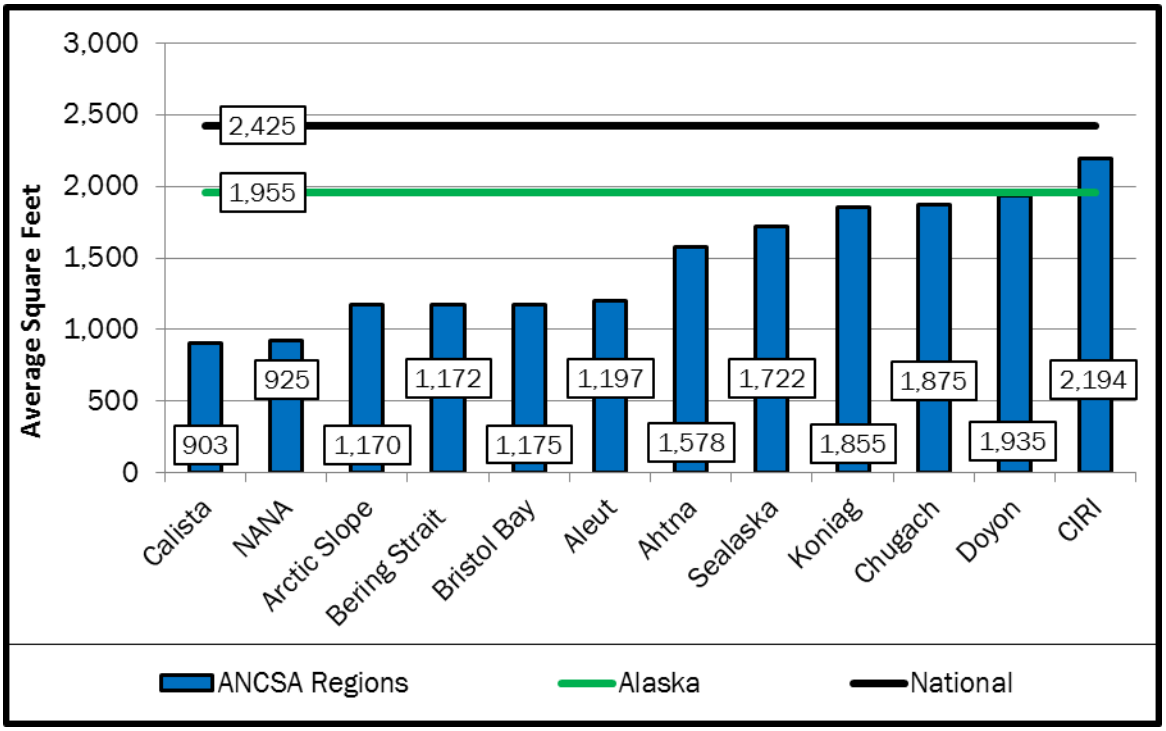


While the average for Alaska (1,955 sq. ft.) is larger than the average for the U.S. Western Region (1,710 sq. ft.), half of Alaska's ANCSA regions have an average house size that is less

than 50 percent of the national average. Homes in Calista average 903 sq. ft., or 37 percent of the national average of 2,425 sq. ft.[49]

Within Alaska, regional average house sizes vary by approximately 1,291 sq. ft. (Fig. 23). On average, the smallest homes are found in western and northern Alaska, with homes in Calista and NANA regions averaging slightly more than 900 sq. ft. The largest homes are found in the CIRI region and average 2,194 sq. ft., approximately two times the size of homes in Calista and NANA regions. Despite homes in the CIRI region having the largest average size, their average energy costs are among the lowest due to low natural gas costs, and average energy use is among the highest.

Figure 23: Average single-family home size by ANCSA region vs. Alaska

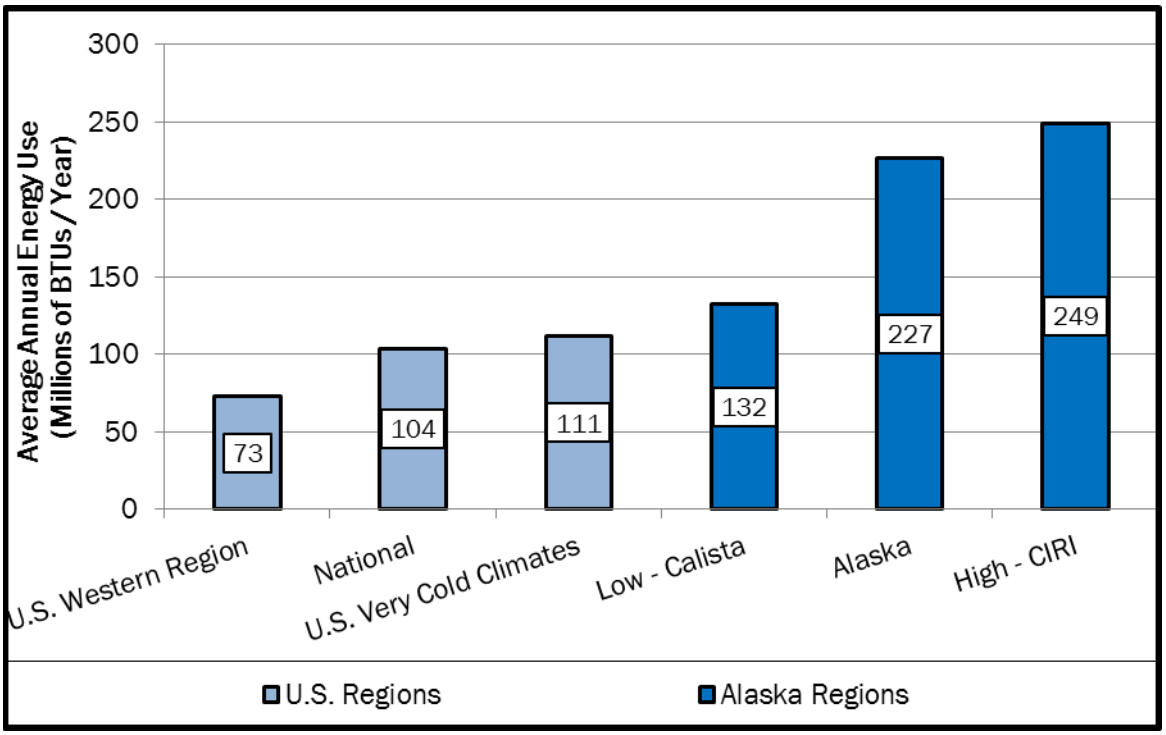


[49] U.S. Energy Information Administration, Independent Statistics and Analysis. (2016). *Residential Energy Consumption Survey (RECS) 2009*. Retrieved from https://www.eia.gov/consumption/residential/data/2009/index.php

Energy Consumption: Annual Energy Use

Based on data from the ARIS database, it is estimated that the average single-family home in Alaska uses approximately twice the energy per year as the average housing unit located in "cold/very cold" climate regions of the United States and approximately three times the energy of units in the western region of the U.S. (Fig. 24). Alaska's relatively high space-heating energy consumption is largely due to climate. The U.S. Department of Energy Building America "cold" climate region has between 5,400 and 9,000 heating degree days per year and "very cold" climate region has between 9,000 and 12,600 heating degree days per year.[50, 51] The average heating degree days in the southernmost portion of the Alaska Panhandle are approximately 7,000 heating degree days per year, while the average in Interior Alaska is approximately 14,000 heating degree days per year and North Slope is approximately 20,000 per year. The U.S. "very cold" climate region includes portions of New England and northern tier states in addition to Alaska.

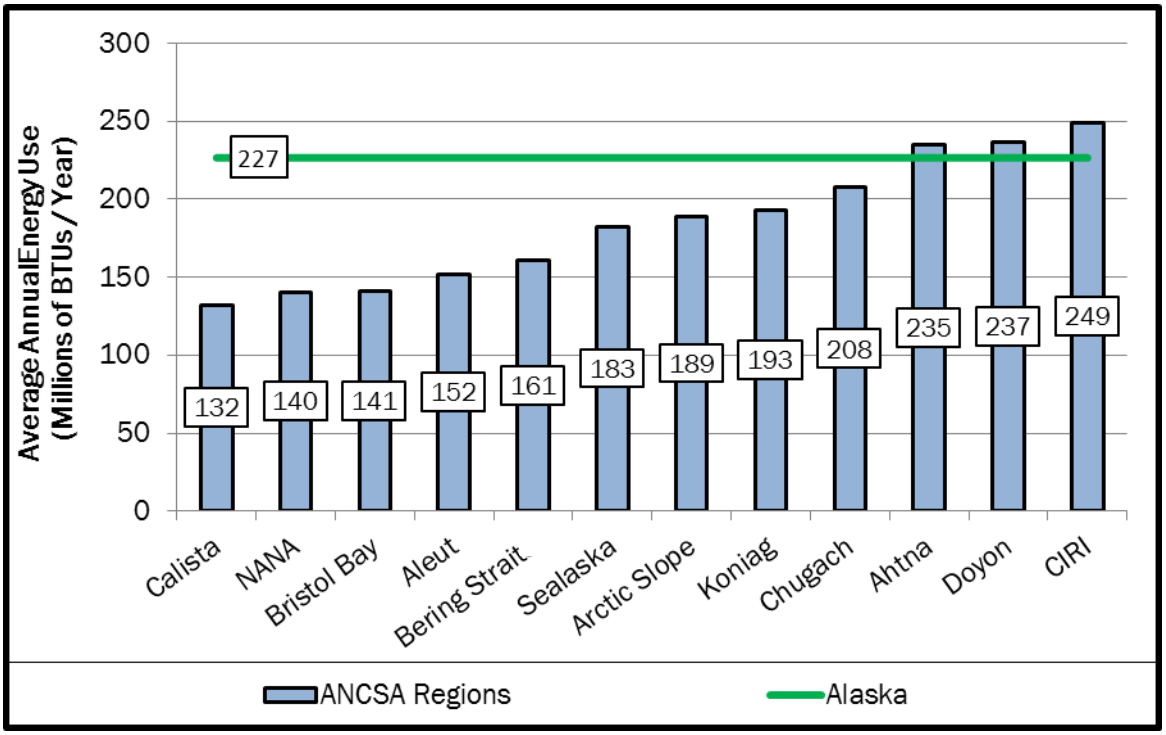
Figure 24: Average annual single-family home energy use in Alaska vs. national RECS estimates



[50] See Fig. 2 for map.
[51] Heating degree days are a measure of heating requirement for a geographic location that is calculated based on the time and magnitude that the temperature stays below a base temperature of 65 degrees Fahrenheit.

Fig. 25 compares average annual energy use by ANCSA region. The CIRI region has the highest average annual home energy use (249 million BTUs per year), approximately 1.1 times the statewide average and approximately 2.4 times more energy than the national average (104 million BTUs per year). Calista is the ANCSA region with the lowest average annual home energy use (132 million BTUs per year). Single-family homes in Calista consume 1.3 times more energy than the national average.[52]

Figure 25: Average annual single-family home energy use by ANCSA region vs. Alaska



[52] Note that this is total consumption of a building, so the relatively small average building size plays a large part in Calista having the lowest energy use.

Energy Consumption: Energy Use Intensity

Energy consumption can also be analyzed using a quantity known as energy use intensity (EUI) that normalizes total energy use by square footage. Using this metric, Fig. 26 shows that the average Alaska EUI is approximately 2.5 times the U.S. "cold/very cold" climate average and three times the U.S. western region average. The Arctic Slope region has the highest EUI in Alaska, using approximately four times the energy per square foot as an average home in the U.S. Western region. The lowest average EUI for an ANCSA region in Alaska is found in Sealaska region and is more than twice the national average for "cold/very cold" climates.

Figure 26: Average annual single-family home energy use intensity in Alaska vs. national RECS estimates

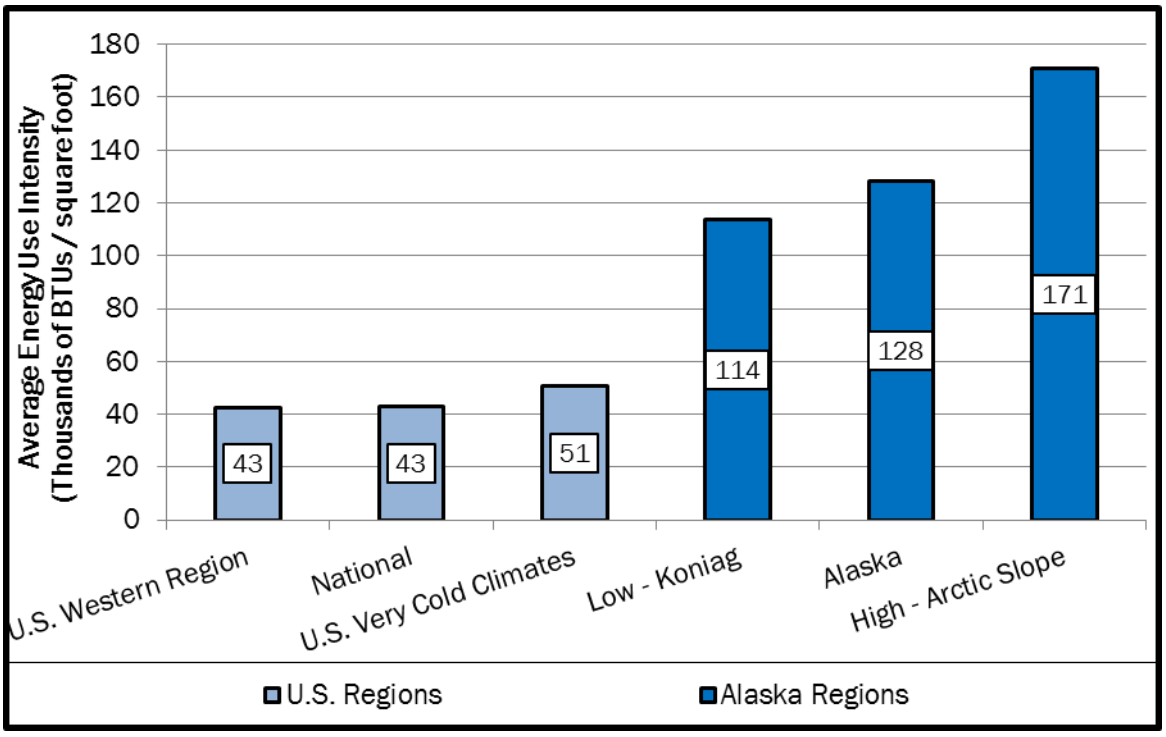
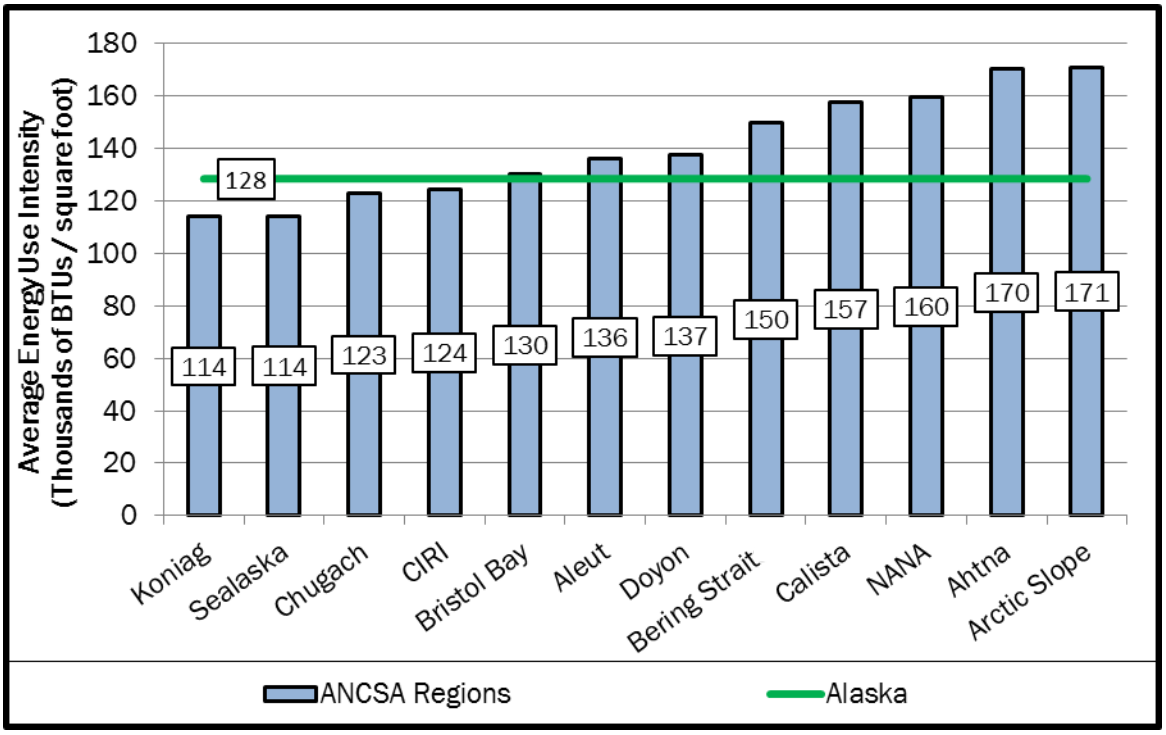


Fig. 27 shows the average EUIs for ANCSA regions in Alaska, as compared to the statewide annual average EUI of 128,000 BTU per square foot. The highest EUIs are predominantly found in the western and northern coastal regions. The lowest energy use is found in the southeastern and southcentral coastal regions, which have some of the lowest energy costs, largest home sizes and warmest climates. As a combination of their southern latitudes and coastal conditions, these are some of the more mild temperature regimes in the state.

Figure 27: Average annual single-family home energy use intensity by ANCSA region vs. Alaska



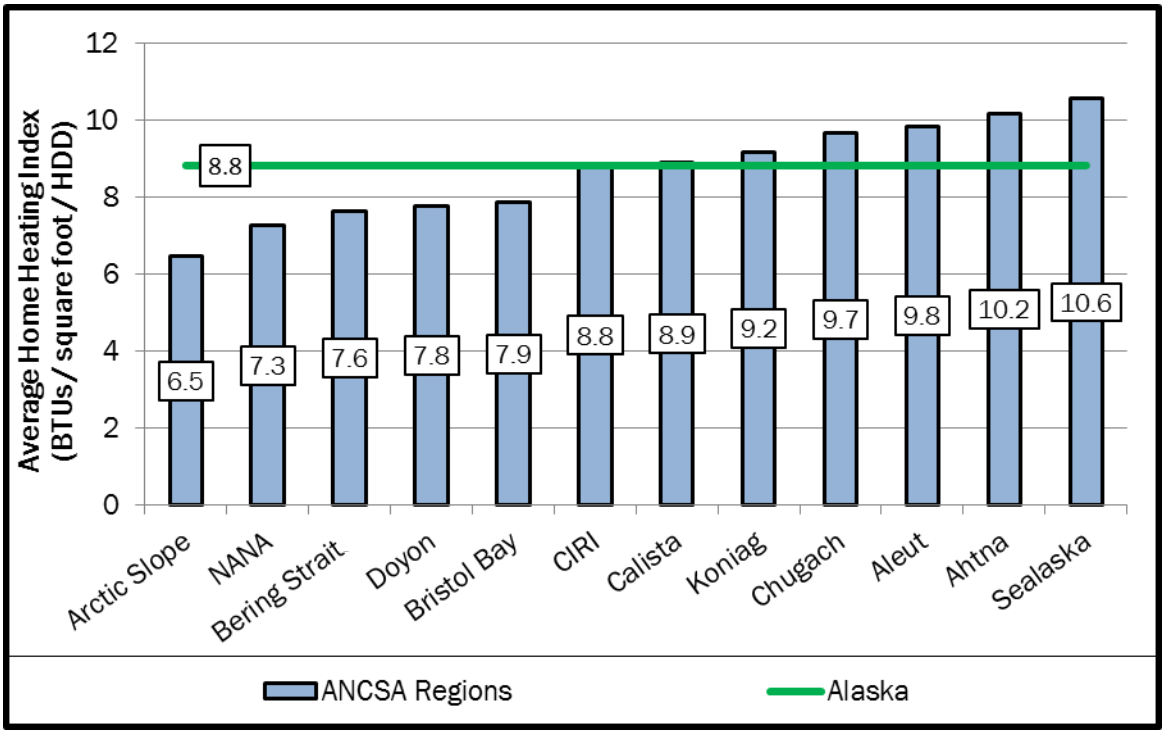
Energy Consumption: Home Heating Index

When comparing residential energy efficiency between regions with different climates, the home heating index (HHI) is often used. The HHI is a measure of the energy used for space heating in a building normalized by square footage and climate. It can be used to compare the energy efficiency of homes even when they have different sizes and are located in different climates. Measurements for the HHI score are BTUs of energy per square foot per heating degree day (BTU/ft^2/HDD).

While there are no national estimates of average home heating index, Fig. 28 shows average home heating index for Alaska's ANCSA regions compared to the statewide average. A HHI score of 10 is considered worse than average and comparable to 1970s-era construction. HHI scores greater than 10 are considered "energy inefficient," meaning homes require significant

fuel for space heating. HHI scores of eight to 10 are comparable to 1980s-era construction. HHI scores of five to eight are comparable to older homes that have been retrofitted with energy-efficient measures.[53] There are no ANCSA regions with average HHI scores better than this range. In Alaska the Arctic Slope and NANA regions have the lowest average HHI scores; interpreted another way, they are the most energy-efficient homes in the state for space heating. The least energy-efficient homes are found in the Ahtna and Sealaska regions, where average HHI scores are greater than 10.

Figure 28: Average single-family home heating index by ANCSA region vs. Alaska



[53] Grainer, T., Hodges, L., Huelman, P., Yearns, M., Baker, K. (1988). "The Home Heating Index." *Housing and Society* vol. 15, no. 1.

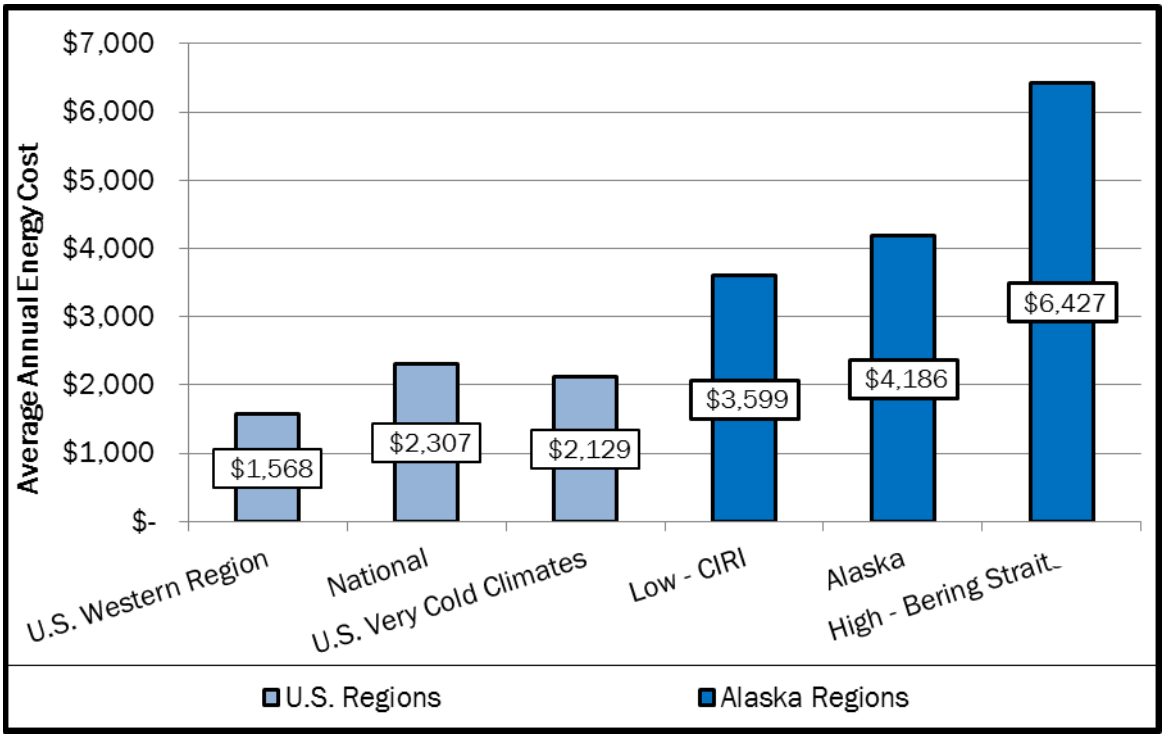
Energy Costs: Annual Energy Costs

Housing stock in Alaska has pronounced differences from nationwide averages when it comes to energy, starting with primary heating fuel types. Fuel oil is used in approximately 31.4 percent of housing units statewide versus fewer than 7 percent of housing nationwide according to ACS estimates.

Fuel oil prices in Alaska differ from national numbers. The price per gallon in 100 surveyed communities in Alaska averaged $4.49 in January 2017, nearly $2 more than the national average of $2.34.[54] In the most remote Alaska communities this price can be even higher with regional maximum prices ranging from $4.60 in Southeast to $12 in Interior Alaska.[55]

Energy costs in Alaska are significantly higher than national averages (Fig. 29). Alaska's average annual energy costs ($4,186) are more than twice the national average ($2,307). The lowest costs in Alaska are found in the CIRI region ($3,599), where more than half of the state's population resides. This cost is still approximately 56 percent higher than the national average.

Figure 29: Average annual single-family home energy cost in Alaska vs. national RECS estimates



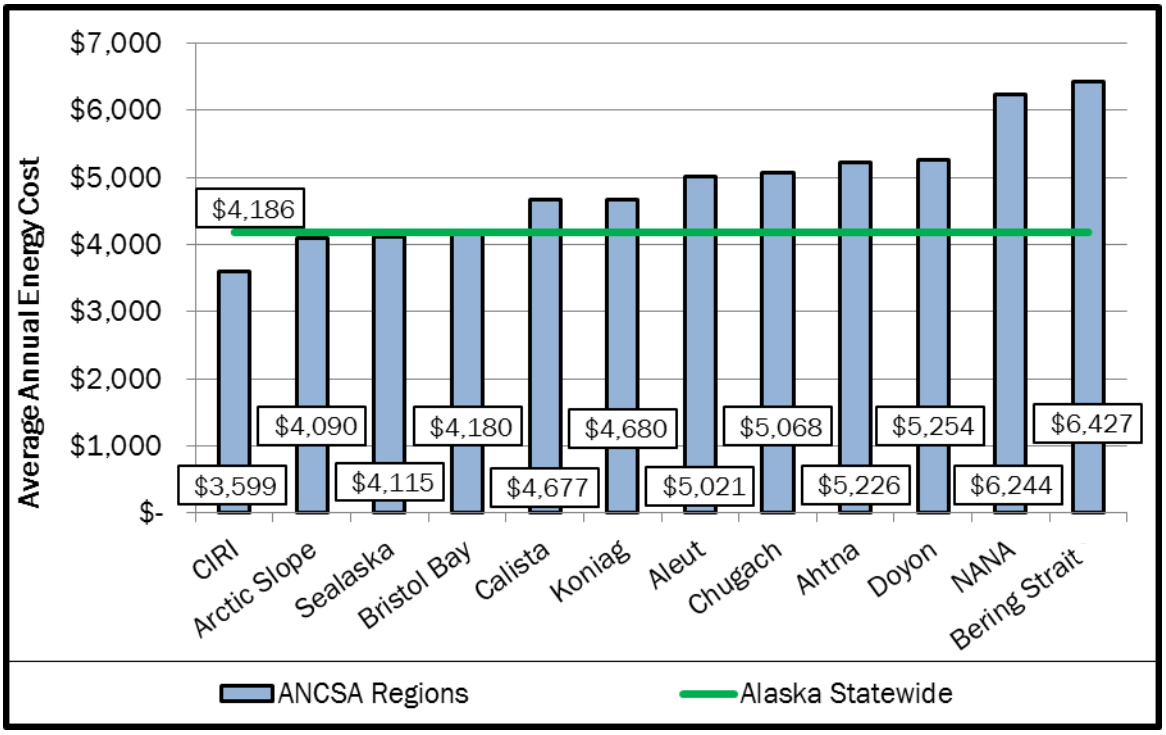
[54] Alaska Department of Commerce, Community, and Economic Development. (2017). *Alaska Fuel Price Report: Current Community Conditions*. Retrieved from https://www.commerce.alaska.gov/web/Portals/4/Fuel Price Report January 2017 As posted.pdf

[55] Ibid. Excludes subsidized fuel in the North Slope region.

The statewide average energy cost is lower than all ANCSA regions except CIRI and Arctic Slope. The highest annual energy costs can be found in the Bering Straits region where the average household is estimated to spend approximately $6,427 on home energy per year, more than four ties the average household cost of energy in the U.S. western region.

Fig. 30 shows the average ANCSA regional energy costs in Alaska as compared to the statewide annual average energy cost of $4,186. Each region in Alaska has a higher estimated average annual energy cost than the U.S. national "cold/very cold" region average ($2,129). The highest costs in Alaska are found in the western coastal and interior regions as these areas have some of the highest heating loads and most expensive fuel oil prices.

Figure 30: Average annual single-family home energy cost by ANCSA region vs. Alaska



The lowest energy costs in Alaska are found in the CIRI and Arctic Slope regions in part because households have access to lower-priced natural gas. Heating oil is subsidized in areas of the Arctic Slope region without access to natural gas. Although CIRI and Arctic Slope households have similar energy costs, there are regional differences with homes in CIRI being approximately 69 percent larger than homes in the Arctic Slope region.

Energy Costs: Energy Cost Index

The average energy cost index (ECI) normalizes energy costs for home size by considering the energy cost per square foot. Fig. 31 shows that when comparing ECIs, Alaska spends even more on energy relative to national averages. At one extreme, the NANA region spends approximately seven times as much per square foot as the U.S. average for "cold/very cold" climates. Single-family households in CIRI, the lowest cost region in Alaska, spend approximately 1.7 times as much on energy per square foot as the national average, and use approximately 2.4 times as much energy annually.

Figure 31: Average annual single-family home energy cost index in Alaska vs. national RECS estimates

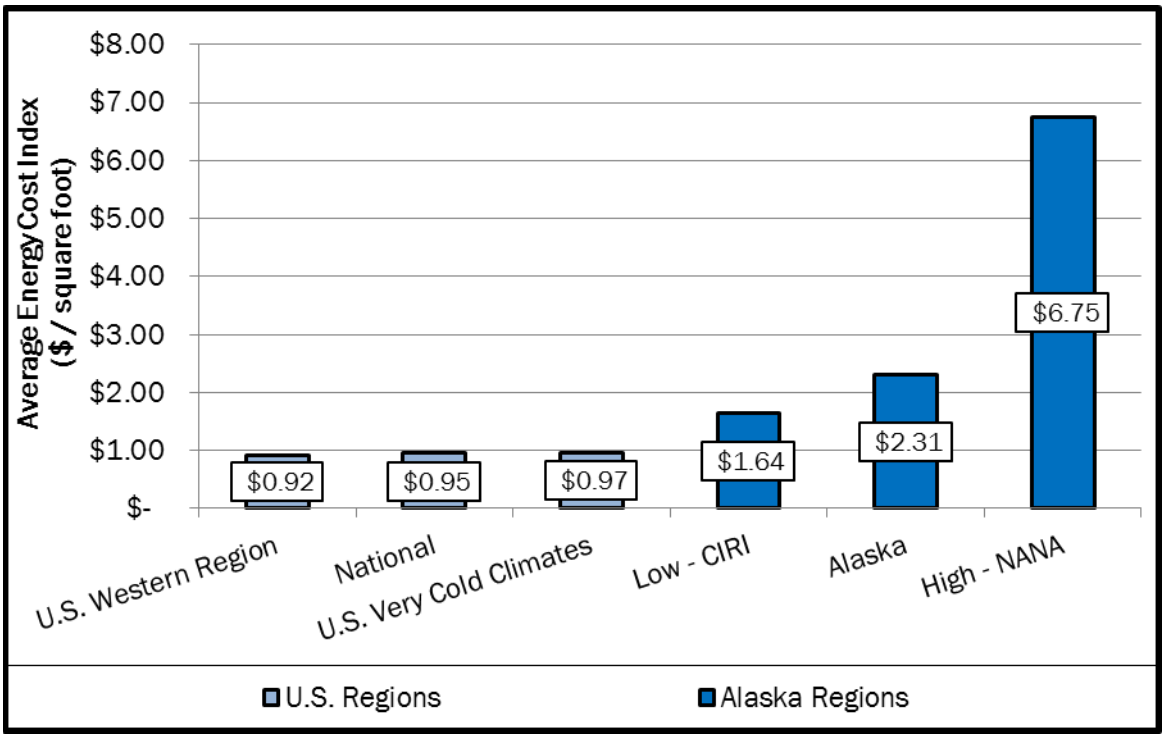
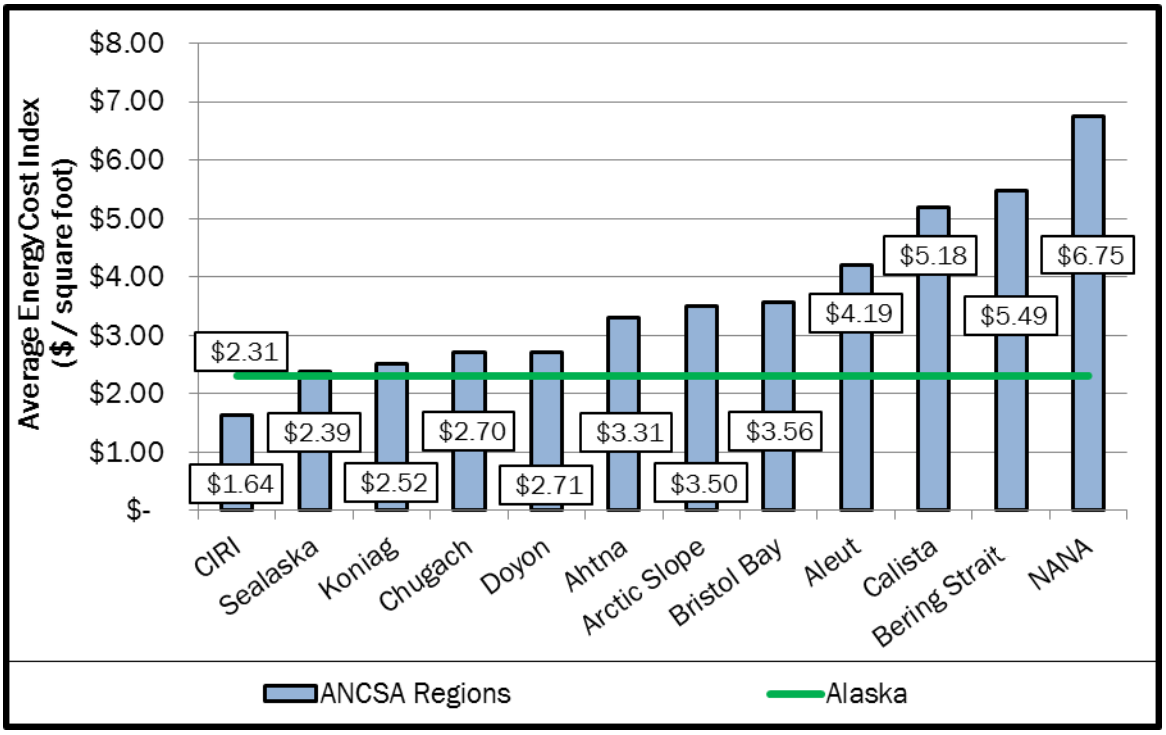


Fig. 32 compares the average ECI for each of Alaska's regions, with the statewide average as a reference point. Within Alaska, the highest average ECI is found in the NANA region followed by the Bering Straits and Calista regions. NANA and Bering Straits regions have the highest total annual energy cost despite having significantly smaller average housing unit sizes than the statewide average, contributing to their high ECIs. CIRI and Sealaska are regions with the lowest ECIs and are both among regions with the lowest annual energy costs.

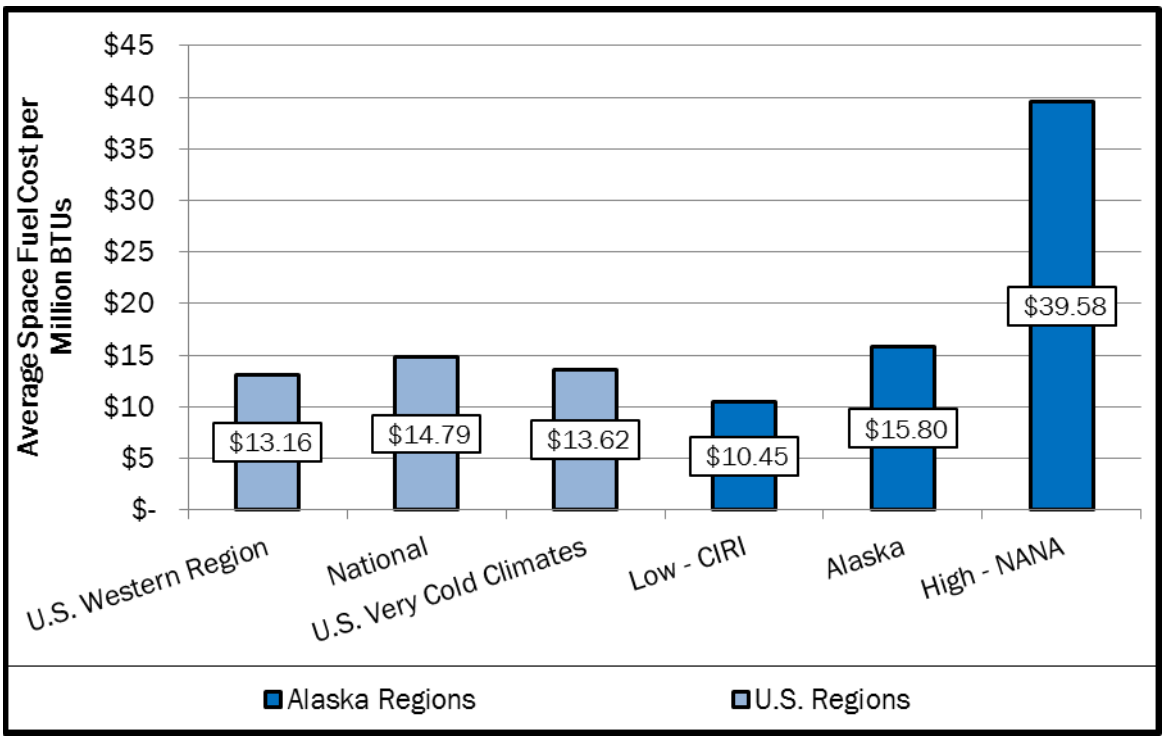
Figure 32: Average annual single-family home energy cost index by ANCSA region vs. Alaska



Energy Costs: Space Fuel Cost per Million BTUs

The average space fuel cost per million BTUs normalizes energy costs for a set amount of fuel consumed for space heating. Fig. 33 shows that Alaska's average cost with this metric is slightly higher than the national average. The CIRI region is the least expensive region with average space fuel costs per million BTUs around 71 percent of the national average. The most expensive ANCSA region, NANA, is 2.7 times the national average of $14.79 per million BTUs.[56]

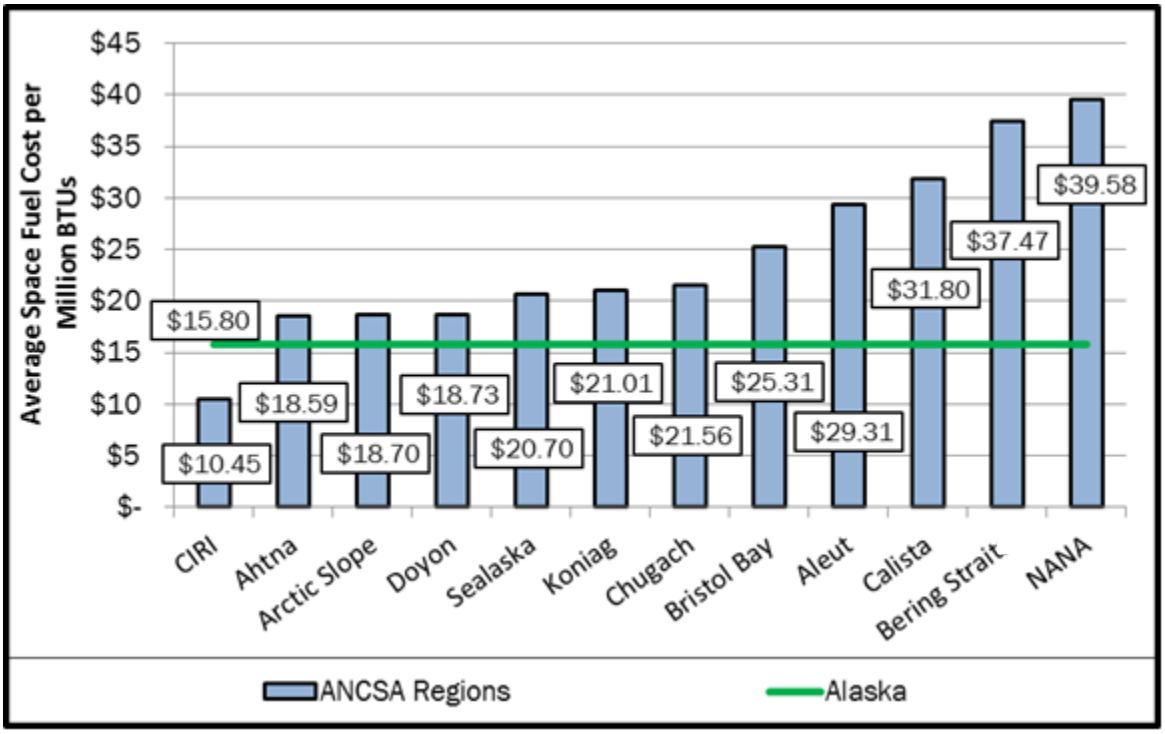
Figure 33: Average single-family home space fuel cost per million BTUs in Alaska vs. national RECS estimates



[56] MMBTU = one million British thermal units of energy. MMBTUs are a neutral unit of measure for comparing energy use regardless of fuel type.

Fig. 34 compares the average space fuel cost per million BTUs for each of Alaska's regions with the statewide average as a reference point. Within Alaska, the highest average cost is found in the NANA region, followed by the Bering Straits and Aleut regions. NANA and Bering Straits regions have among the highest average energy costs despite comparatively low average annual energy use. All three regions have average space fuel costs per million BTUs that are more than two times higher than the statewide average. CIRI is the region with the lowest average energy cost indices, a result of inexpensive natural gas.

Figure 34: Average single-family home space fuel cost per million BTUS by ANCSA region vs. Alaska



Interpreting the Energy Data: NANA Case Study

The NANA region has the highest ECI of any region in the state ($4.67/ft^2) and the highest space fuel cost at $34/MMBTU. NANA's average ECI is 4.3 times the average ECI for Alaska. The NANA region has the second lowest average HHI score for single-family homes, indicating that homes are efficient on average. The NANA region also has the third highest energy use per square foot that is likely due to its colder climate. Climate and fuel costs lead to the highest average annual energy costs in the state, costing residents in single-family homes with more than $7,500 in costs per year on average.

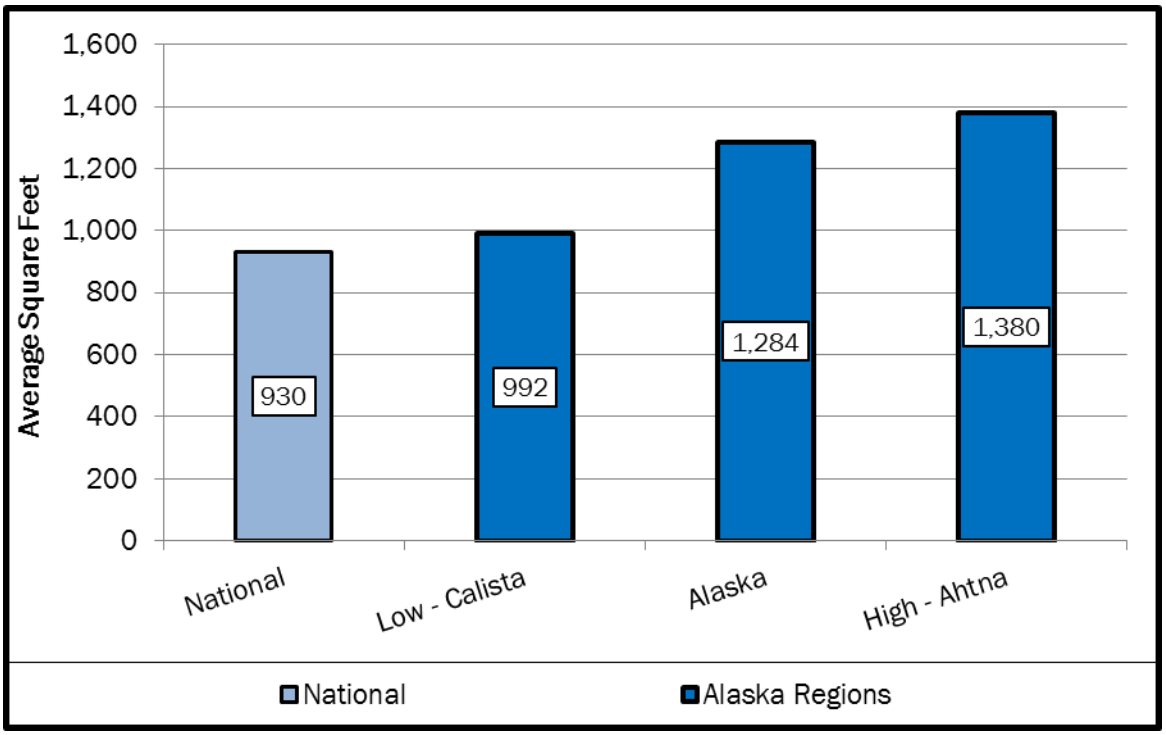
Multifamily Units

For purposes of this assessment, housing units are further evaluated by single-family units and multifamily units. A multifamily unit is defined as a single dwelling for a single household within a larger building. These can be apartments, condominiums, duplexes, triplexes and other similar structures but are not mobile homes and standalone homes. According to ACS estimates, approximately 28 percent of households in Alaska live in multifamily housing units.

Housing Unit Size

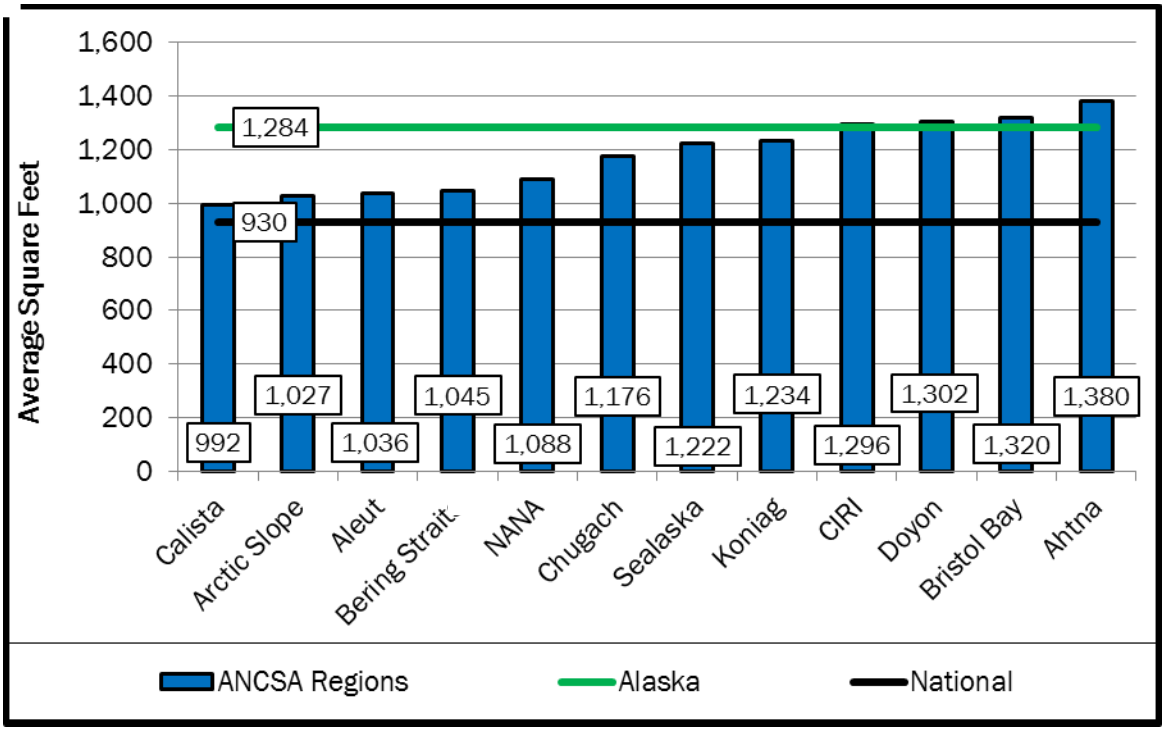
Multifamily housing units in Alaska are larger than the national average (Fig. 35). In fact, each ANCSA region has an average multifamily housing unit size that is more than the national average. Multifamily housing units in Calista region average 992 sq. ft., more than the national average of 930 sq. ft. Units in Ahtna region average 1,380 sq. ft., or approximately 48 percent larger than the national average.

Figure 35: Average multifamily housing unit size in Alaska vs. national RECS estimates



Within Alaska, regional average multifamily unit sizes vary by approximately 388 sq. ft. (Fig. 36). The smallest units are found in western and northern Alaska, with homes in the Calista and Arctic Slope regions averaging approximately 1,000 sq. ft. Units in Ahtna region average 1,380 sq. ft., or approximately 1.4 times the size of Calista and Arctic Slope units. The majority of ANCSA regions with larger units contain Alaska's larger population centers.

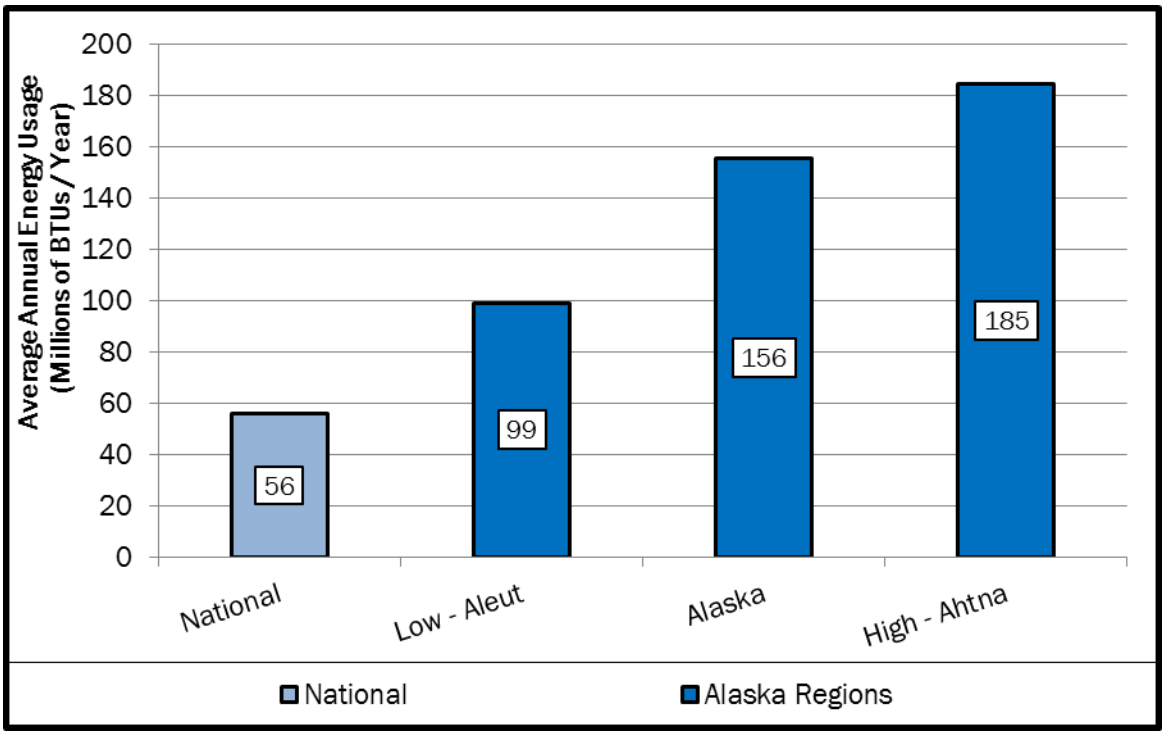
Figure 36: Average multifamily housing unit size by ANCSA region vs. Alaska



Energy Consumption: Annual Energy Use

Based on information from AHFC's ARIS database, the average Alaska multifamily housing unit uses approximately 2.8 times more energy than the national average (Fig. 37). Alaska's relatively high space heating energy consumption is largely due to climate. The U.S. Department of Energy Building America "cold" climate region has between 5,400 and 9,000 heating degree days per year and the "very cold" climate region has between 9,000 and 12,600 heating degree days per year.[57, 58] The average in Southeast Alaska is approximately 7,000 heating degree days per year, while Interior Alaska averages approximately 14,000 heating degree days per year and the North Slope averages approximately 20,000 per year.

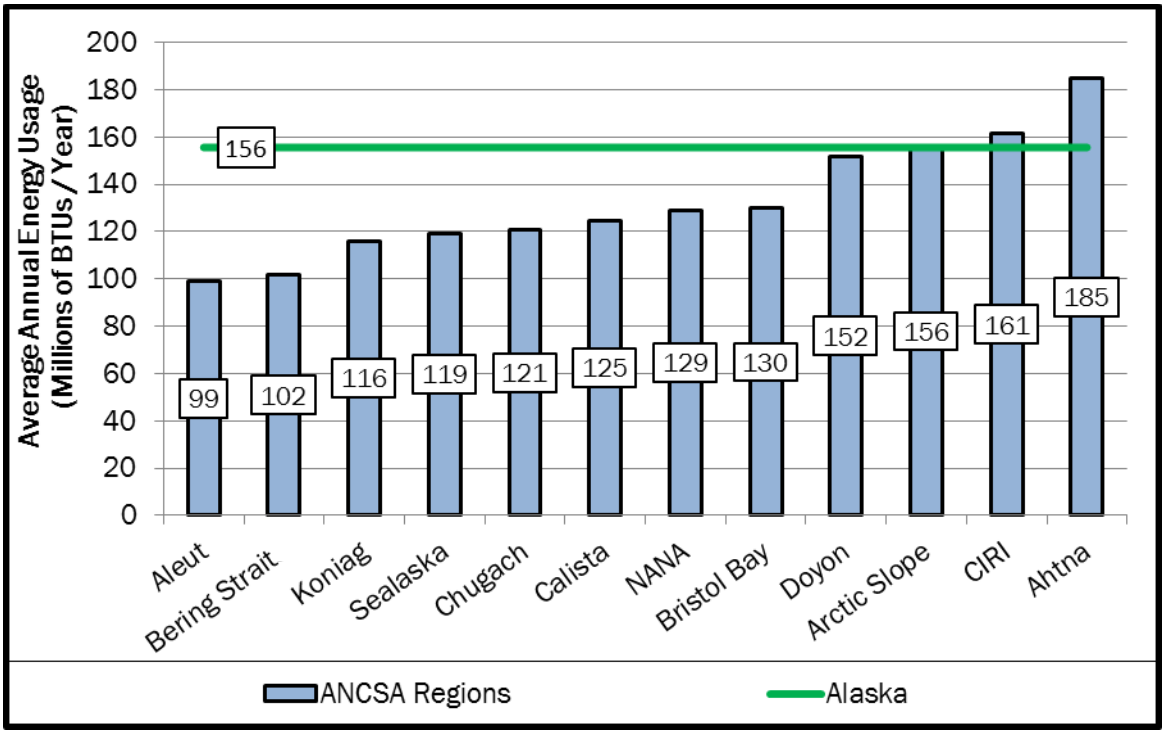
Figure 37: Average annual multifamily housing unit energy use in Alaska vs. national RECS estimates



[57] See Fig. 2 for map.
[58] Heating degree days is a measure of the heating requirement for a geographic location that is calculated based on the time and magnitude that the temperature stays below a base temperature of 65 degrees Fahrenheit.

The ANCSA region with the highest average annual housing unit energy usage, Ahtna, uses approximately 3.3 times more energy than the national average. The Aleut region has the lowest average annual home energy use, and it uses approximately 1.8 times more energy than U.S. averages.[59] CIRI and Arctic Slope regions have among highest average annual energy usage and lowest average annual energy costs.

Figure 38: Average annual multifamily housing unit energy use by ANCSA region vs. Alaska



[59] This is total consumption of a building so the relatively small average building size plays a large part in Calista having the lowest energy use.

Energy Consumption: Energy Use Intensity

Energy consumption can be analyzed using a quantity known as energy use intensity (EUI) that normalizes total energy use by square footage. Using this metric, Fig. 39 shows that the average Alaska EUI is approximately 2.1 times the national average. The Arctic Slope region has the highest EUI in Alaska, using approximately 2.8 times more energy per square foot than the national average. The lowest EUI in the state, found in the Bristol Bay region, is approximately 1.7 times the national average.

Figure 39: Average annual multifamily housing unit energy use intensity in Alaska vs. national RECS estimates

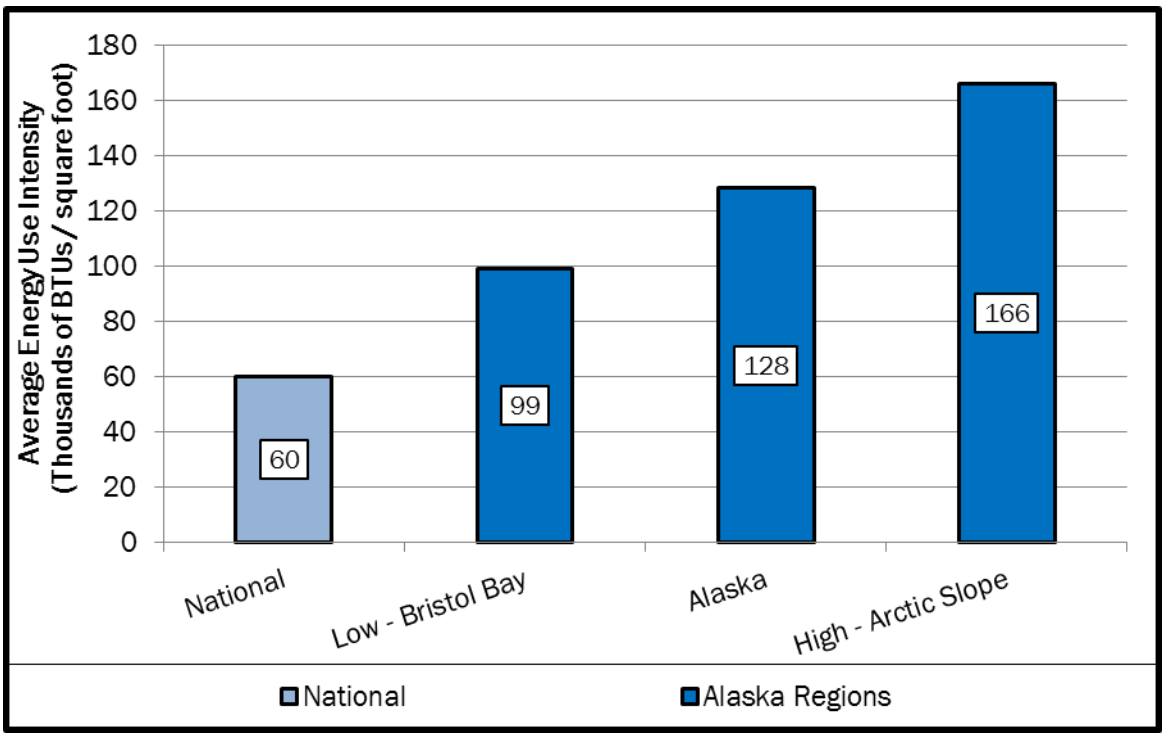
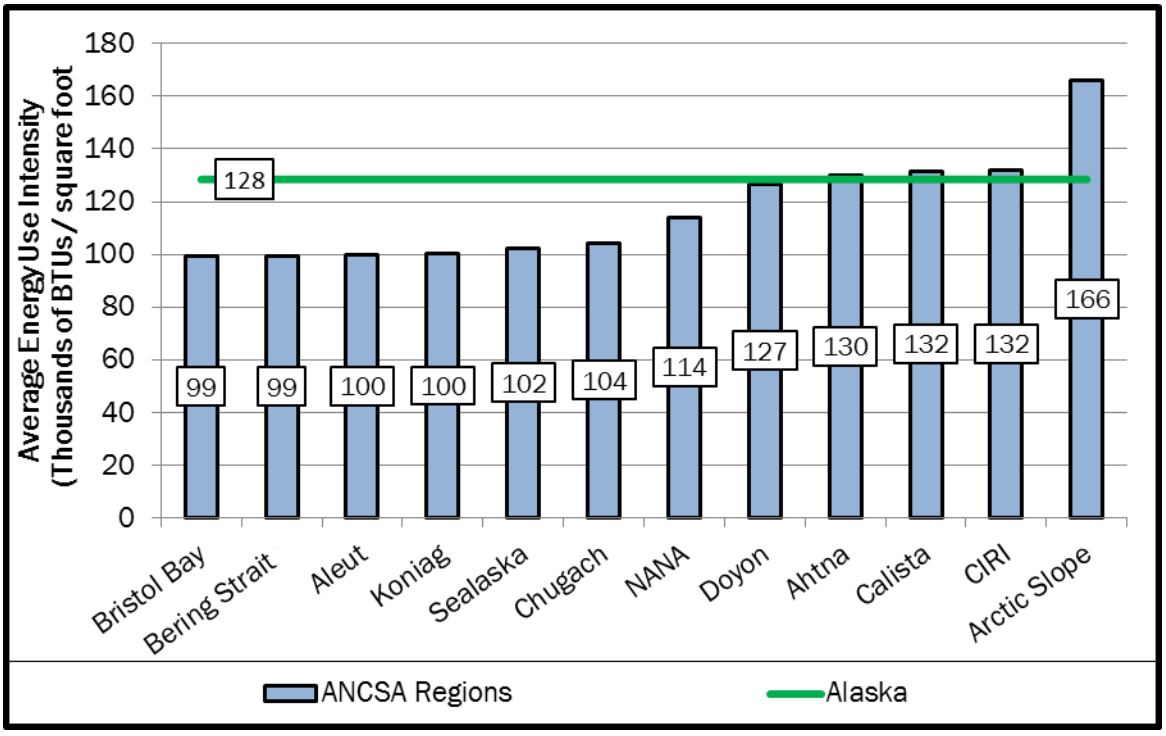


Fig. 40 shows the average ANCSA regional EUIs in Alaska, as compared to statewide annual average EUI of 128,000 BTU/square foot. The highest EUIs are found in Arctic Slope and CIRI regions, the two with the lowest energy costs. The lowest EUI is found in Bristol Bay and Bering Straits regions.

Figure 40: Average annual multifamiy housing unit energy use intensity by ANCSA region vs. Alaska

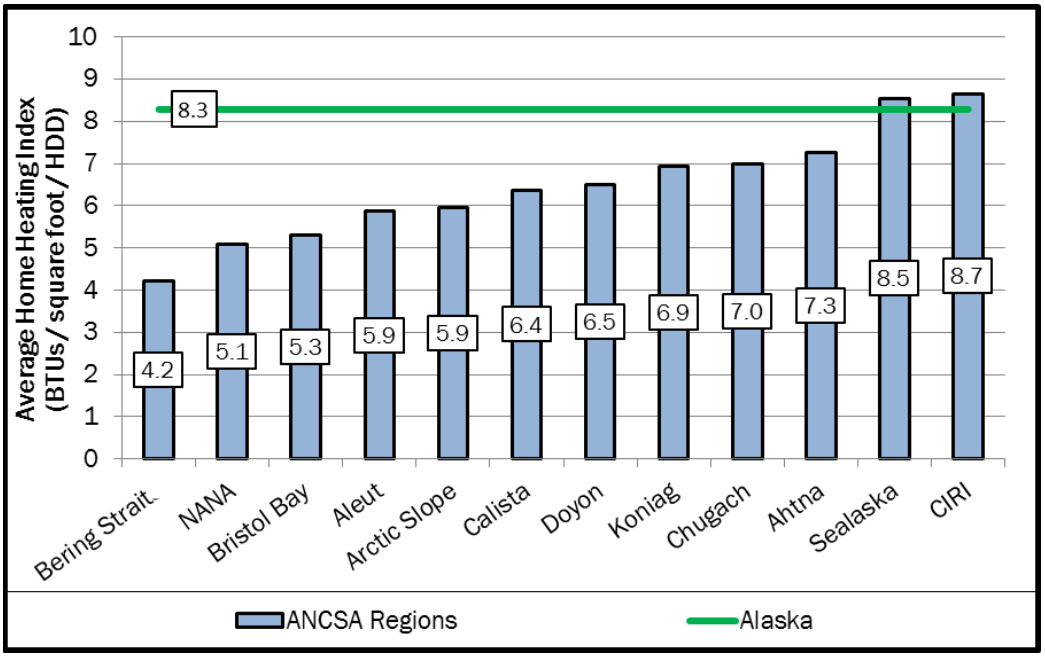


Energy Consumption: Home Heating Index

When comparing residential energy efficiency between regions, the HHI score is often used.[60] The HHI score is a measure of energy used for space heating in a building normalized by square footage and climate; thus it can be used to compare energy efficiency of homes even when they have different sizes and are located in different climates.

While there are no national estimates of average HHI scores, Fig. 41 shows the average HHI scores for Alaska's ANCSA regions. As noted, a HHI score of 10 is considered worse than average. Results greater than 10 are considered "energy inefficient," meaning homes require significant fuel for space heating. HHI scores of eight to 10 are comparable to 1980s-era construction. HHI scores of five to eight are comparable to older homes that have been retrofitted with energy efficient measures. HHI scores of two to four are considered typical of the most efficient new homes.[61] In Alaska, the Bering Straits and NANA regions have the lowest average HHI scores, having the most energy-efficient multifamily housing units for space heating. The least energy-efficient multifamily housing units are found in CIRI and Sealaska regions where average HHI scores are greater than eight.

Figure 41: Average multifamily housing unit home heating index by ANCSA region vs. statewide

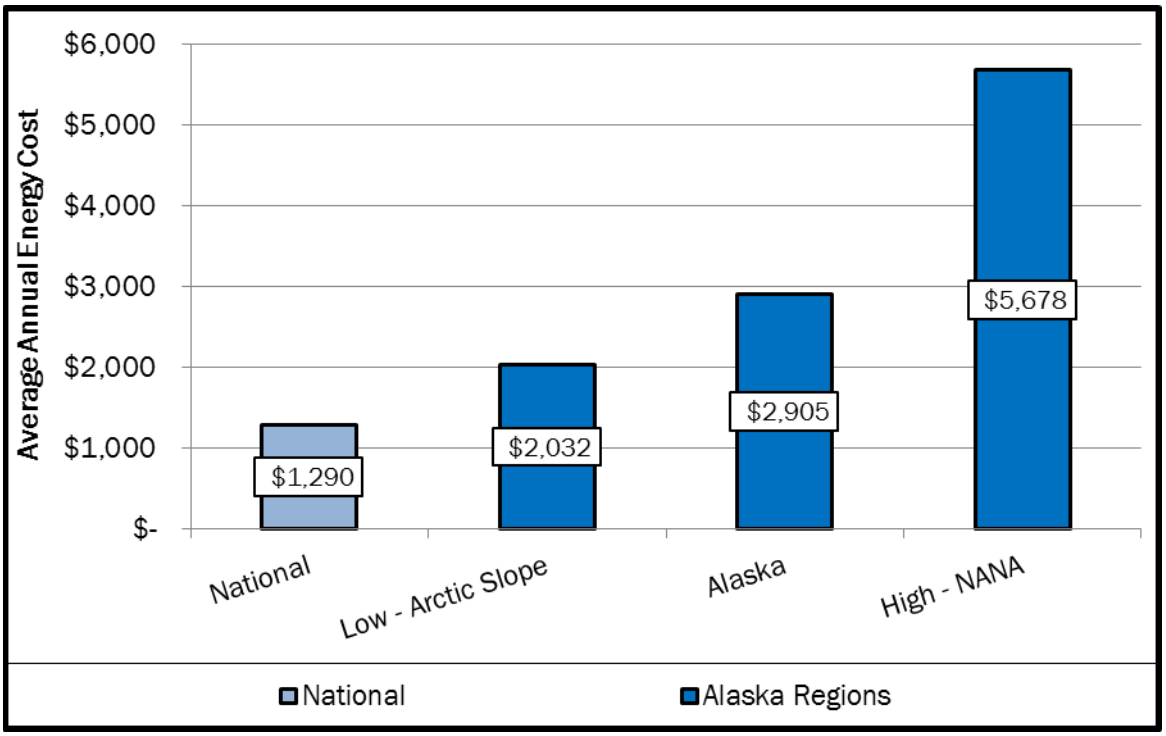


[60] HHI = home heating index. The units for the HHI score are BTU/ft²/HDD.
[61] Grainer, T., Hodges, L., Huelman, P., Yearns, M., & Baker, K. (1988). "The Home Heating Index." *Housing and Society* vol. 15, no. 1.

Energy Costs: Annual Energy Costs

Energy costs in Alaska are significantly higher than national averages (Fig. 42). Alaska's statewide average annual energy cost ($2,905) is approximately 2.3 times the national average ($1,290). The statewide average is lower than all regions except Arctic Slope and CIRI regions. The lowest costs are found in the Arctic Slope region ($2,032), where the cost of residential fuel is subsidized.[62] This cost is approximately 57 percent higher than the national average. The highest annual energy costs can be found in the NANA region where the average household in a multifamily housing unit is estimated to spend approximately $5,678 on home energy per year, nearly 4.4 times the national average.

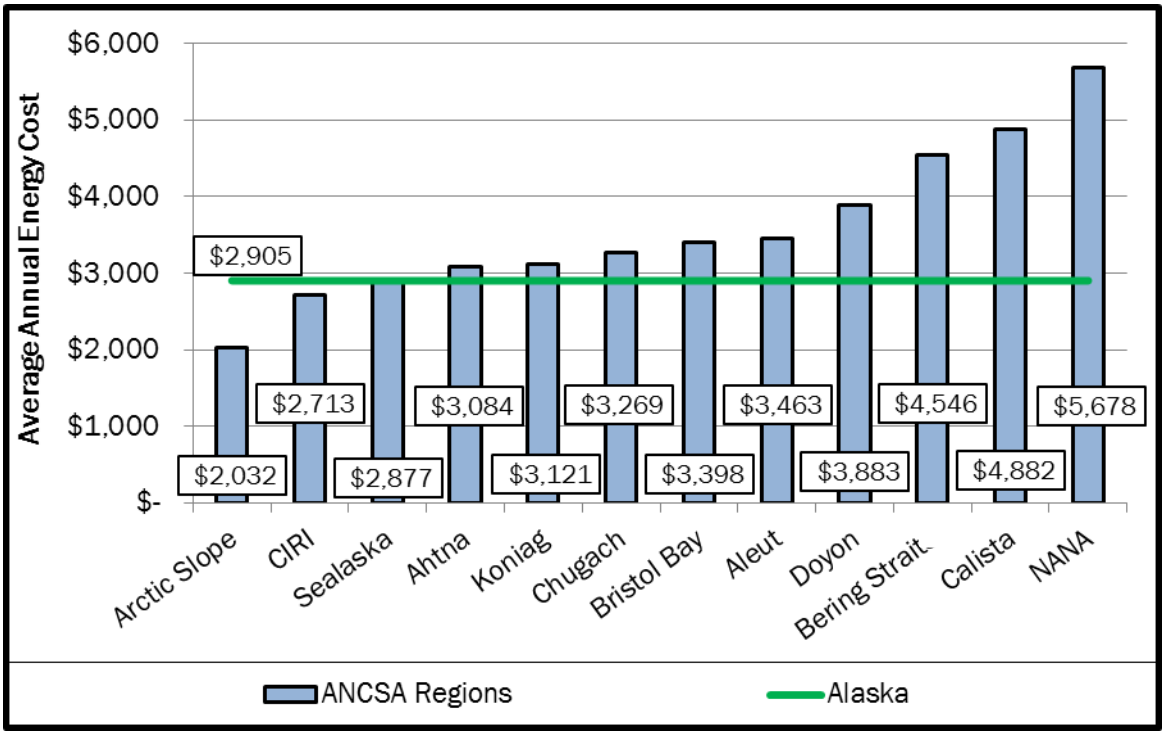
Figure 42: Average annual multifamily housing unit energy cost in Alaska vs. national RECS estimates



[62] WH Pacific. (2015). *North Slope Borough Regional Energy Plan*. Retrieved from http://www.north-slope.org/assets/images/uploads/Feb2015_draft_NSB_Energy_Plan_2.6.15.pdf

Fig. 43 shows the average ANCSA regional energy costs as compared to the statewide annual average energy cost of $2,905. Each region has a higher estimated average annual energy cost than the national average ($1,290). The highest costs in Alaska are generally found in western coastal and interior regions, as these areas have some of the highest heating loads and most expensive fuel oil prices. The highest annual energy costs are found in NANA and Calista regions.

Figure 43: Average annual multifamily housing unit energy cost by ANCSA region vs. Alaska



The lowest energy costs in Alaska are found in Arctic Slope and CIRI regions. These regions feature annual energy costs that are $1,000 to $3,000 less than the majority of other ANCSA regions in part because households have access to low-priced natural gas. Heating oil is also subsidized in areas of the Arctic Slope region without access to natural gas. Although CIRI and Arctic Slope households have similar energy costs, there are regional differences, with multifamily housing units in the Arctic Slope being more energy efficient than those in the CIRI region.

Energy Costs: Energy Cost Index

The average energy cost index (ECI) normalizes energy use for home size by considering energy cost per square foot. Fig. 44 shows that when comparing ECIs, Alaska spends even more on energy relative to national averages. At one extreme, the NANA region spends approximately 3.8 times as much on energy per square foot as the national average. Arctic Slope, the lowest cost region in Alaska, spends approximately 42 percent more on energy per square foot than the national average ($1.39/ft^2).

Figure 44: Average annual multifamily housing unit energy cost index in Alaska vs. national RECS estimates

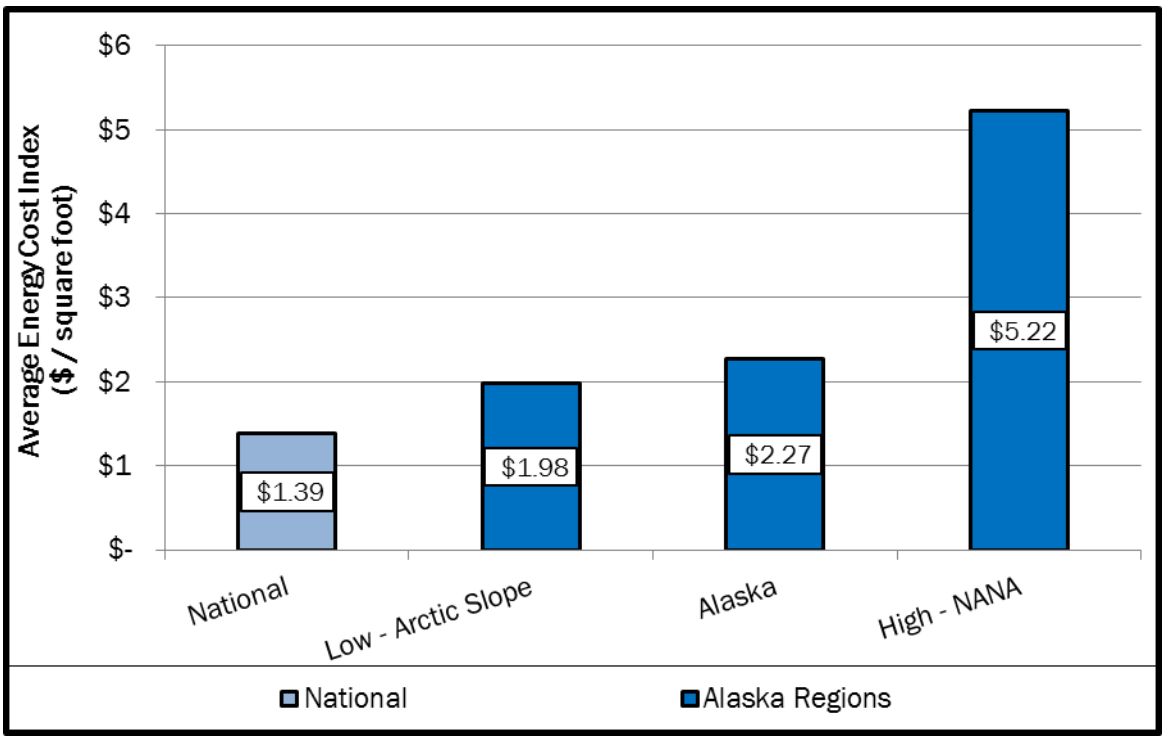
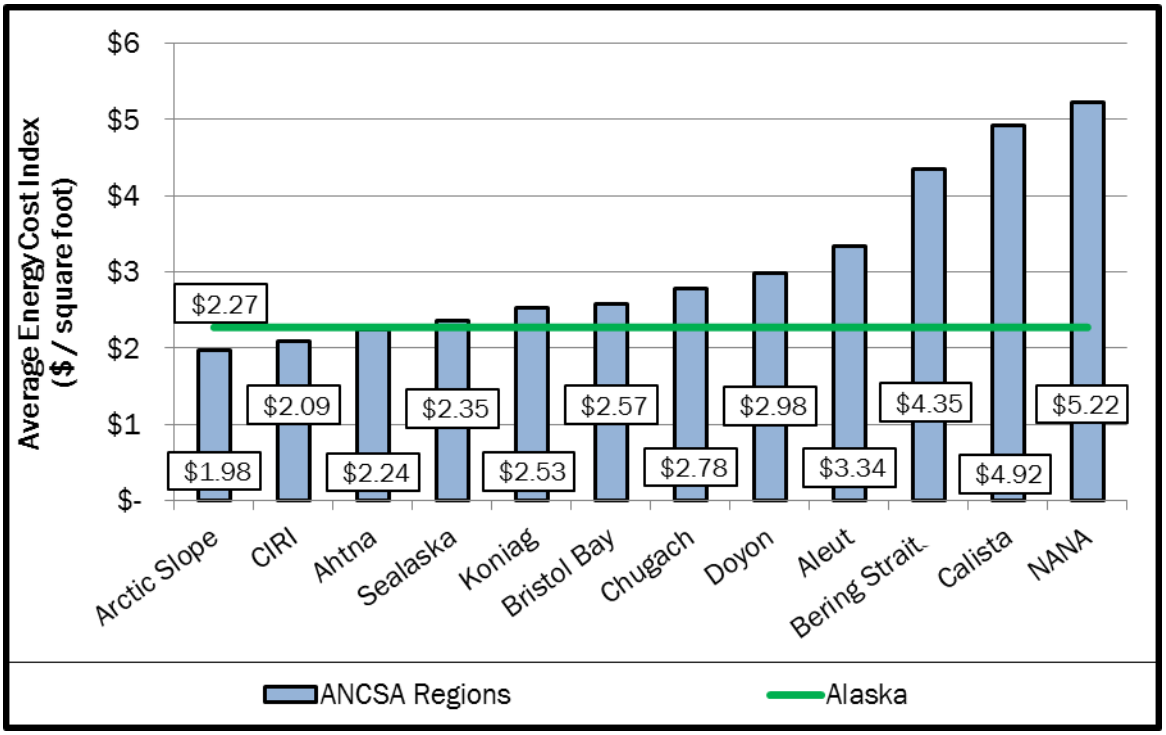


Fig. 45 compares the average ECI for each of Alaska's regions, with the statewide average of $2.27/ft^2 as a reference point. The highest average ECI is found in the NANA region ($5.22/ft^2), followed by Calista ($4.92/ft^2) and Bering Straits ($4.35/ft^2) regions. NANA region has the highest total annual energy cost despite having significantly smaller housing unit sizes than the statewide average, contributing to their high ECIs. The Arctic Slope and CIRI regions have the lowest ECIs and are among the regions with lowest annual energy costs and highest energy use.

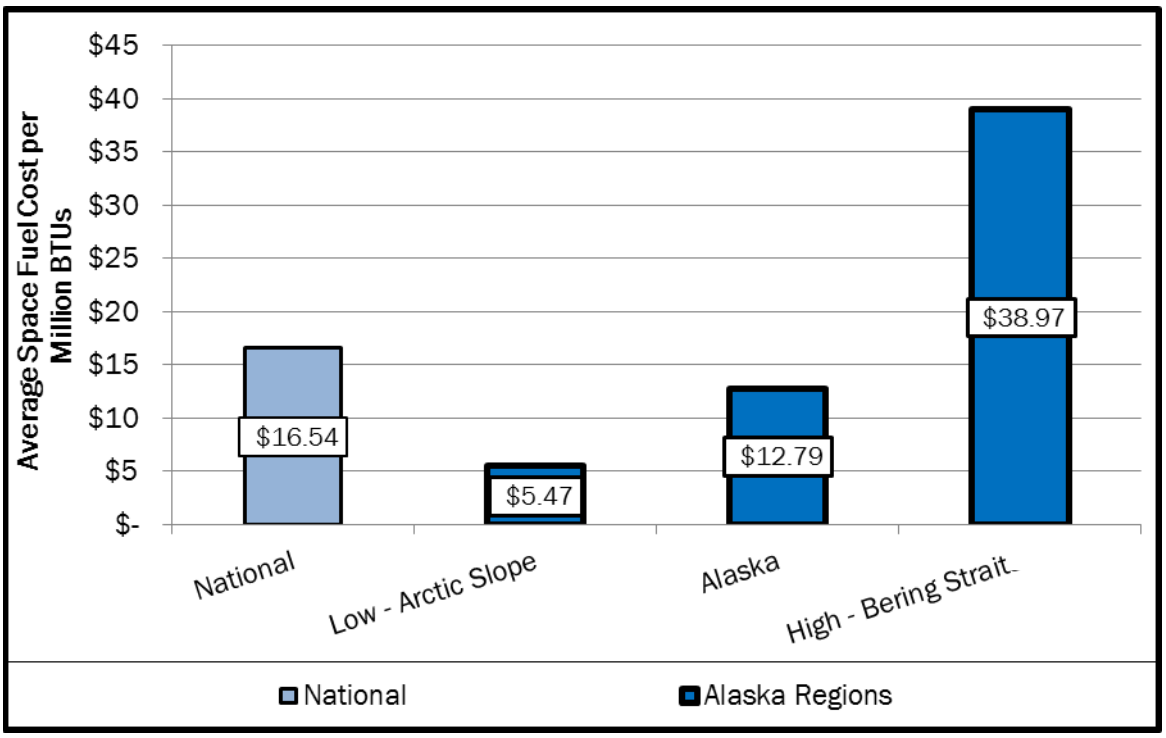
Figure 45: Average annual multifamily housing unit energy cost index by ANCSA region vs. Alaska



Energy Costs: Space Fuel Cost per Million BTUs

The average space fuel cost per million BTUs normalizes energy cost by looking at costs for a set amount of fuel consumed for space heating. Fig. 46 shows that Alaska's average space fuel costs are approximately 77 percent of the national average. The Arctic Slope region is the least costly, at around 33 percent of the national average for multifamily housing units. The most expensive ANCSA region, Bering Straits, has a space fuel cost of $38.97 per million BTUs that is approximately 2.4 times the national average of $16.54/MMBTU.

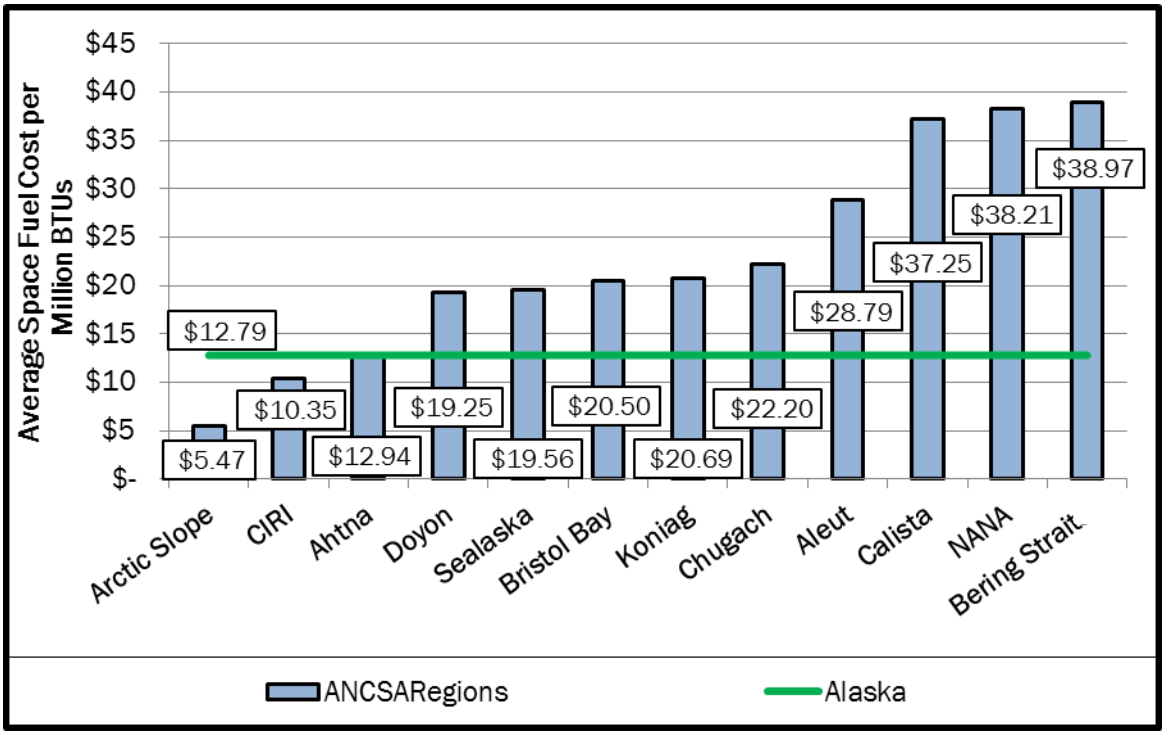
Figure 46: Average multifamily housing unit space fuel cost per million BTUs in Alaska vs. national RECS estimates[63]



[63] Arctic Slope has a subsidy on fuel prices, as previously noted in this report.

Fig. 47 compares average space fuel cost per million BTUs for each of Alaska's regions, with the Alaska average as a reference point. The highest average cost is found in Bering Straits region, followed by NANA and Calista, the regions with highest annual energy costs. All three regions have average space fuel costs per million BTUs that are approximately three times higher than the statewide average. Arctic Slope and CIRI are the regions with the lowest annual energy costs, with the Arctic Slope region's average cost being less than half of the statewide average.

Figure 47: Average multifamily housing unit space fuel cost per million BTUS by ANCSA region vs. Alaska



The Arctic Slope and CIRI regions have access to natural gas, which is less expensive than heating oil. Further, in the Arctic Slope region, heating oil is subsidized in areas without access to natural gas.

ARIS data about energy use and cost is useful for characterizing housing needs. This data shows that energy costs in Alaska are higher on average than national costs and contribute to housing cost burden. This data also allows for regional comparisons, showing the highest energy cost burden is found in western coastal and interior Alaska. This is likely due to a combination of colder climates, higher heating prices and, in some cases, less efficient homes in these areas.

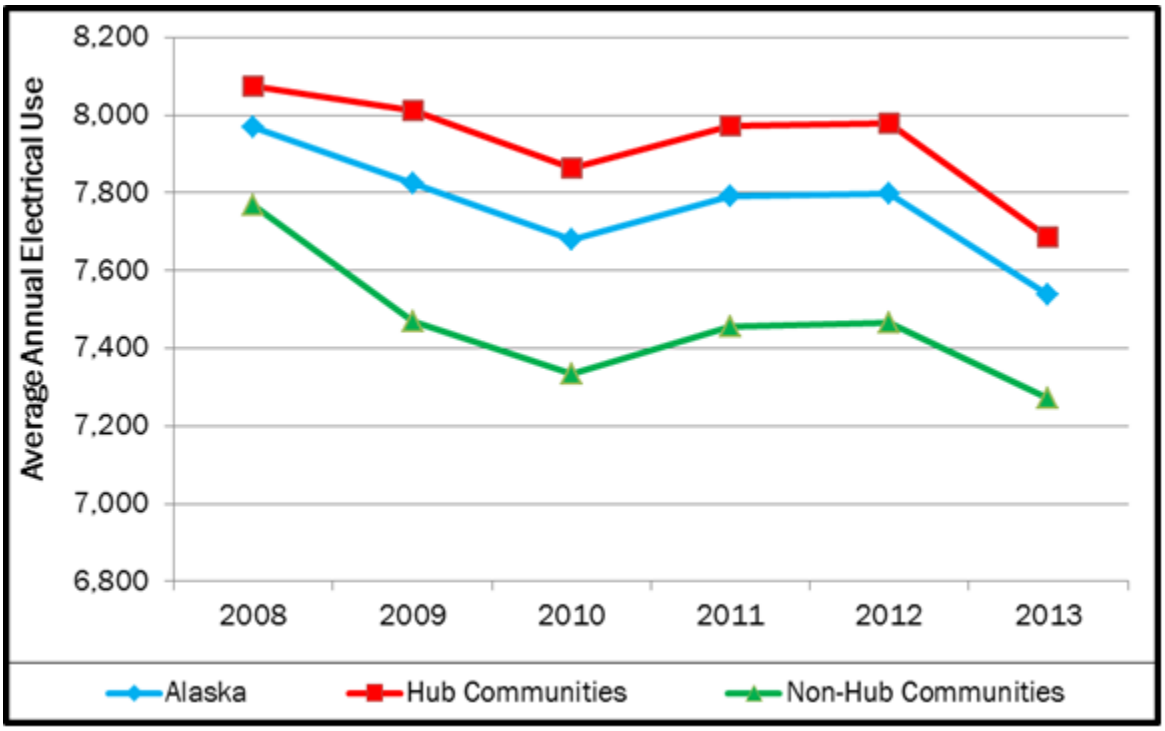
Interpreting the Energy Data: NANA Case Study

The NANA region has the highest ECI of any region in the state ($5.22/ft^2), and the second highest space fuel cost at $38.21/MMBTU. NANA's average ECI is 2.3 times the average for Alaska. The NANA region has lowest average HHI score for multifamily housing units, indicating that housing units are efficient yet cold climate and fuel costs result in the highest average annual energy cost in the state, burdening residents in multifamily units with more than $5,600 in costs per year.

Residential Electrical Trends

In 2013, the average household in Alaska consumed approximately 7,540 kilowatt hours (kWh) of electricity annually, or approximately 628 kWh per month. This was a decrease of 5 percent from average consumption in 2008. Hub communities in the state averaged 7,687 kWh per year in 2013.[64] This is a decrease of 4.7 percent during the same period. Non-hub communities consumed an average of 7,273 kWh in 2013, a decrease of approximately 6.4 percent since 2008.

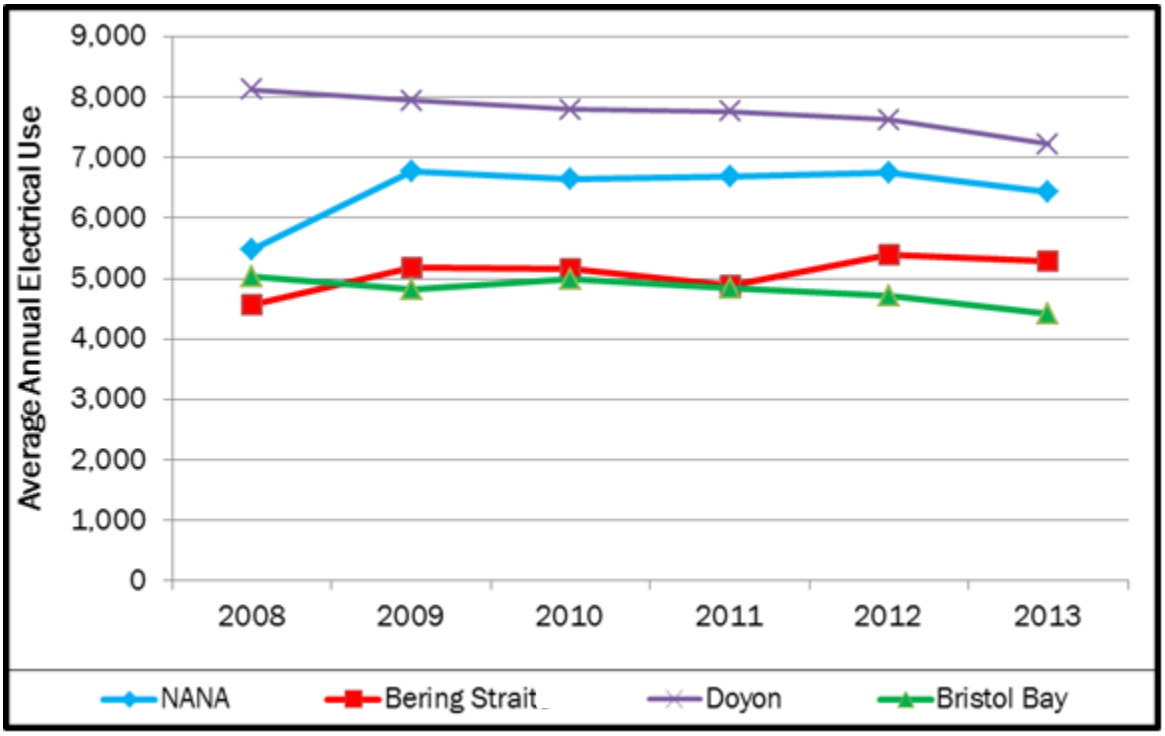
Figure 48: Alaska five-year trends in residential electrical usage



[64] For purposes of this report, a hub community is defined as a city or village that serves as a transportation and commercial center that supports villages. A hub community will also contain a significant portion of the population for a given region.

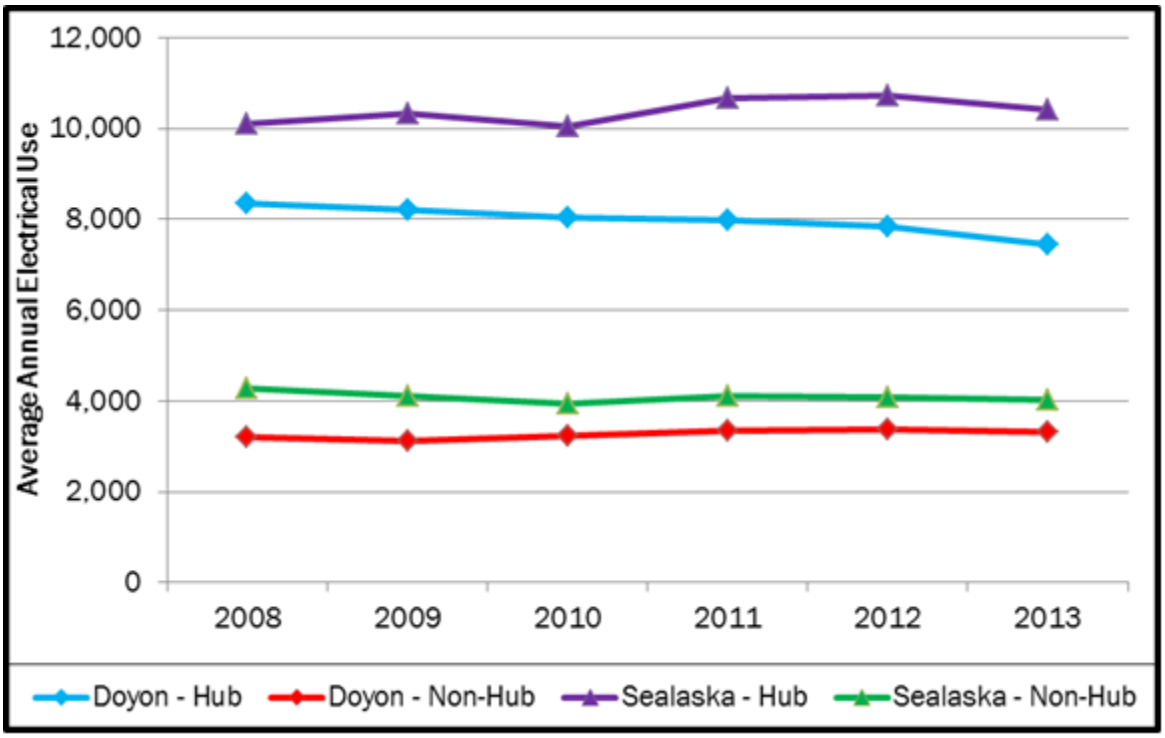
Evaluating household electrical consumption from 2008 to 2013 (Fig. 49) shows the largest increases occurred in NANA and Bering Straits regions, while the largest decreases occurred in Doyon and Bristol Bay regions. In both NANA and Bering Straits regions, the largest single-year increase came between 2008 and 2009 as global energy prices spiked.

Figure 49: Alaska five-year trends in residential electrical usage for select ANCSA regions



Electrical usage was evaluated between hub and non-hub communities in ANCSA regions. Sealaska has the largest difference in usage with hub households consuming approximately 10,426 kWh per year in 2013 and non-hub households consuming approximately 4,026 kWh, a difference of 6,400 kWh. The Doyon region likewise saw hub households (7,432 kWh) consuming more than non-hub households (3,305 kWh). The difference in these regions is likely partially due to higher electricity prices in rural communities that curb consumer demand. Juneau and Fairbanks have larger customer bases that can spread the fixed costs of operating a utility over a greater number of kWh sold; whereas, research shows the high cost of electricity in smaller communities leading to lower average usage.[65]

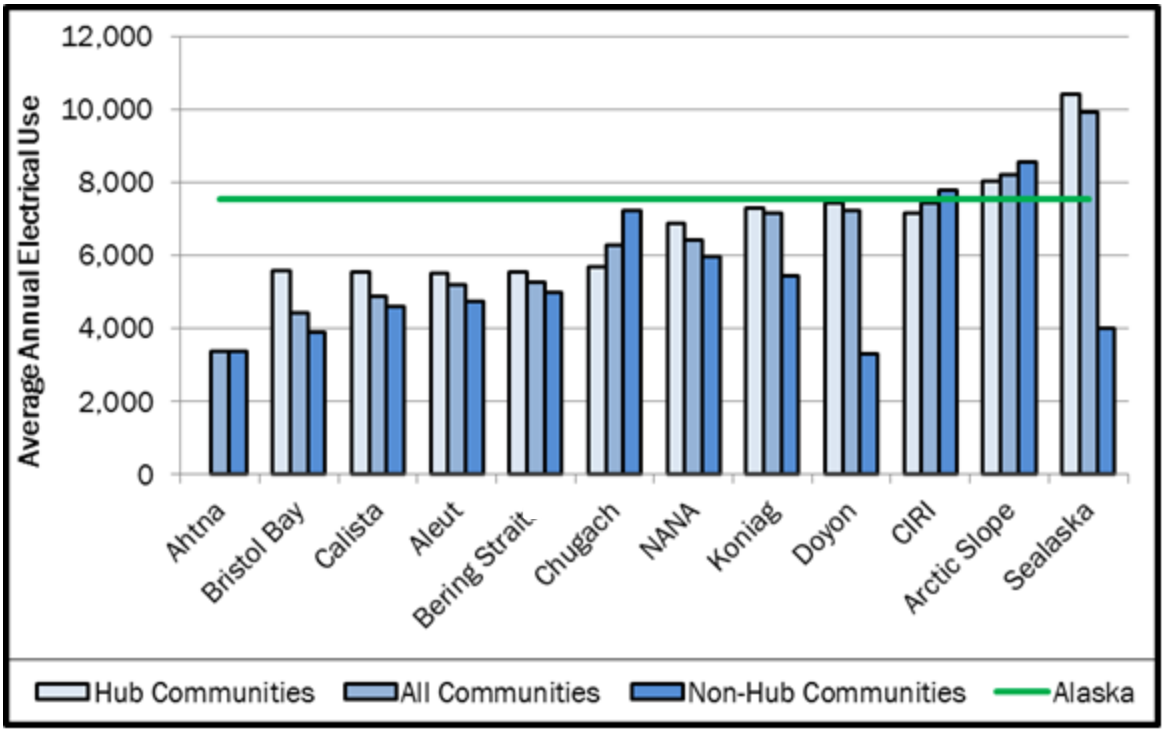
Figure 50: Alaska five-year trends in residential electrical usage for select ANCSA regions



[65] Fay, G., Villalobos Melendez, A., & West, C. (2014). *Alaska Energy Statistics: 1960–2011*. University of Alaska Anchorage, Institute of Social and Economic Research. Retrieved from http://iser.uaa.alaska.edu/Publications/2013_12-AlaskaEnergyStatistics2011Report_Final_2014-04-30.pdf

Fig. 51 shows a comparison of hub and non-hub community annual electrical consumption. Chugach, CIRI and Arctic Slope regions are notable because non-hub average household electrical usage exceeds hub-based average household electrical usage. Ahtna's household electrical usage is approximately half the statewide average.

Figure 51: Average residential electrical usage by ANCSA region vs. Alaska



Housing Condition

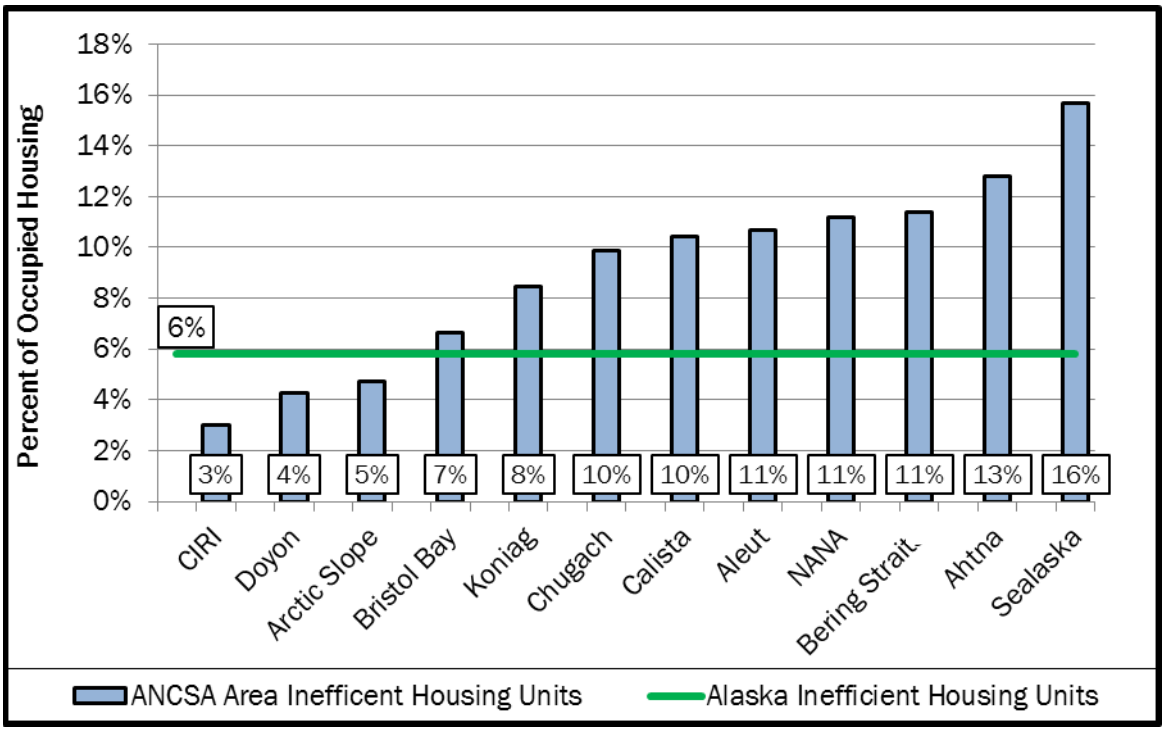
Inefficient Homes

Information in AHFC's ARIS database contains a rating score for each home. These scores reflect the home's energy efficiency and ignore user behavior, serving as an evaluation of the structure alone. The ratings are on a star scale ranging from 1-star to 6-star, with half steps such as 1-star-plus, 2-star-plus, etc.

On average, a 1-star-plus rating will use approximately four times more energy than the same home built to AHFC's Building Energy Efficiency Standard (BEES).[66] A 3-star home uses approximately twice the energy as the same home built to AHFC's BEES. The minimum BEES is equivalent to a 5-star on the rating scale.

Based on information from the ARIS database, it is estimated that approximately 14,600 (6 percent) of occupied single-family housing units in Alaska are built to a 1-star equivalent standard. CIRI and Doyon regions have been identified as having the lowest percentage of homes in this category (Fig. 52).

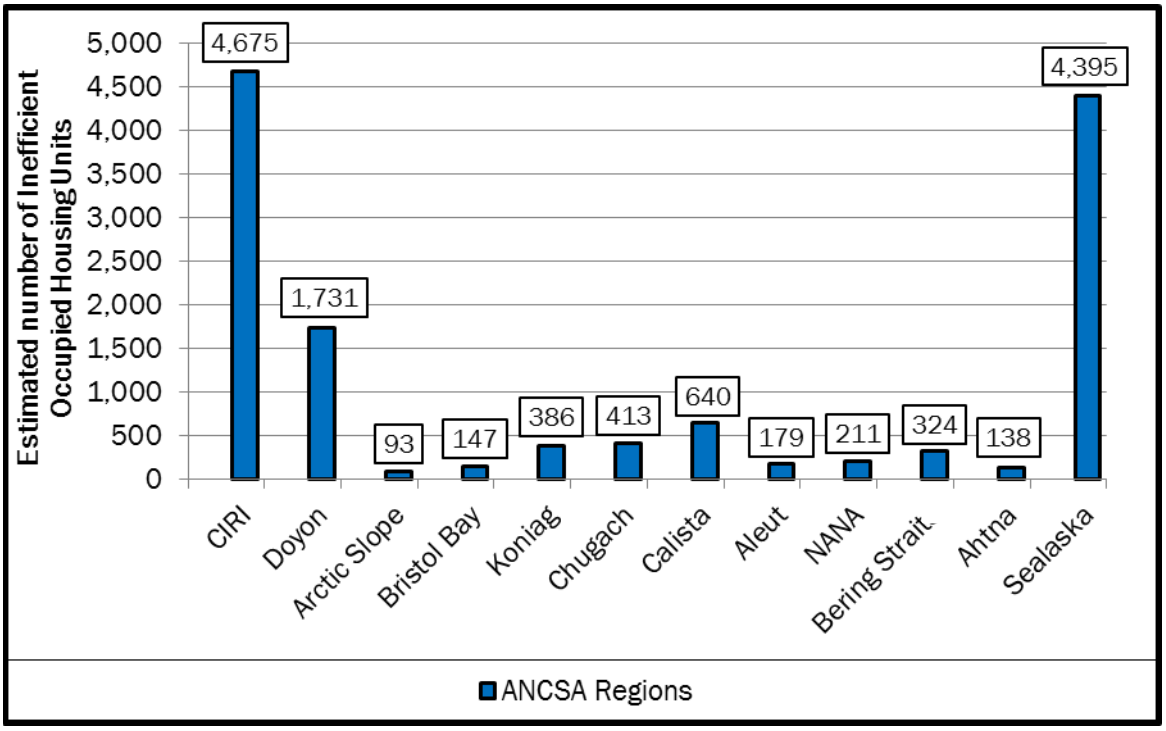
Figure 52: Estimate of occupied inefficient homes by ANCSA region (%)



[66] Alaska's current Building Energy Efficiency Standard is based on the 2012 International Residential Code and sets energy use standards for thermal resistance, air leakage, moisture protection and ventilation in residential buildings.

Because a high percentage of the state's population lives in the CIRI region, it has the second-highest number of homes currently in the 1-star category (4,843), just ahead of the Sealaska region at an estimated 4,395 (Fig. 53).

Figure 53: Estimate of occupied inefficient homes by ANCSA region



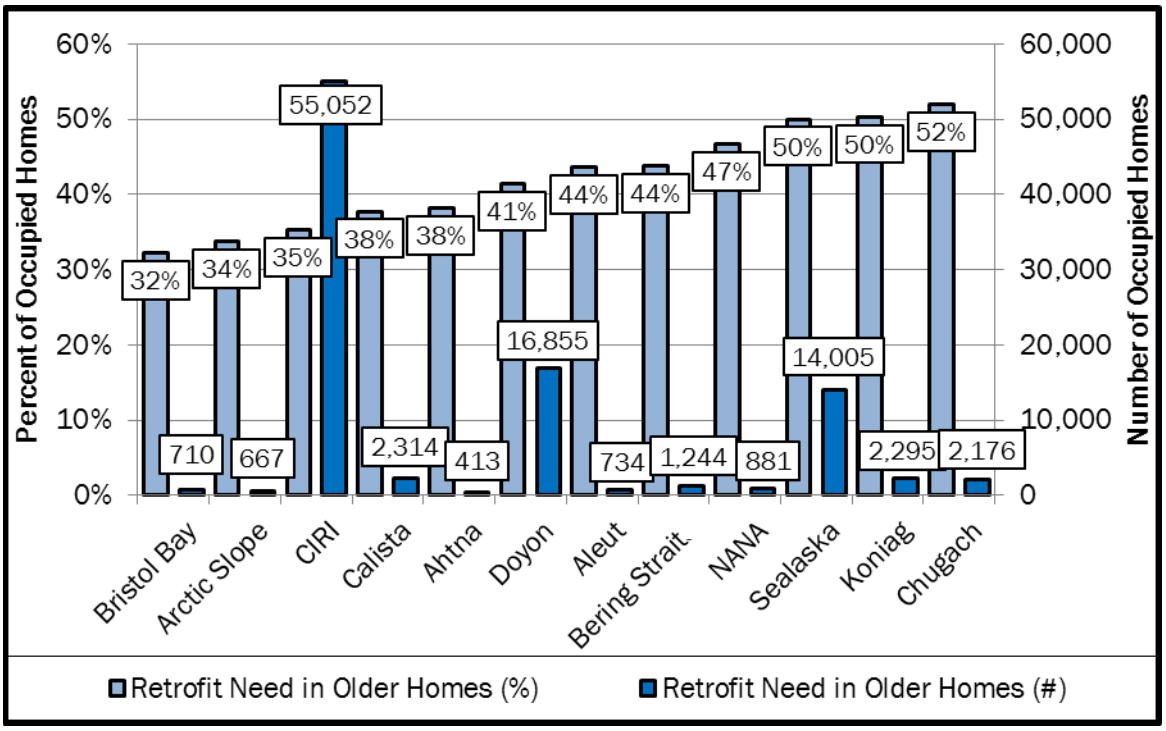
Data from AHFC's Weatherization Assistance Program shows that providing home energy retrofits to 1-star homes can be done cost-effectively, saving twice the energy per dollar spent compared to retrofitting a more efficient 3-star home.[67] Alaska currently has an estimated 14,600 homes with a 1-star energy rating. Energy retrofits for these homes can cost-effectively reduce the burden of energy costs on families and protect against future energy price increases.

[67] Wiltse, N., Valentine, B., & Madden, D. (2014). *Weatherization Evaluation: Additional Findings*. Alaska Housing Finance Corporation.

Older Homes in Need of Retrofit

Alaska's harsh climate prematurely degrades buildings. Homes built before 1980 are already nearly 40 years old or older. Homes that have not been retrofit from this era may be approaching obsolescence. Approximately 50 percent of homes in the Chugiak, Koniag and Sealaska regions have not taken part in one of the state's energy retrofit programs in recent years. The three most populous regions—CIRI, Doyon and Sealaska—have approximately 88,071 homes within these criteria. The Bristol Bay region has the lowest percentage of housing stock meeting these criteria at 32 percent, or 704 homes.

Figure 54: Estimate of older homes in need of retrofit by ANCSA region



Substandard Housing

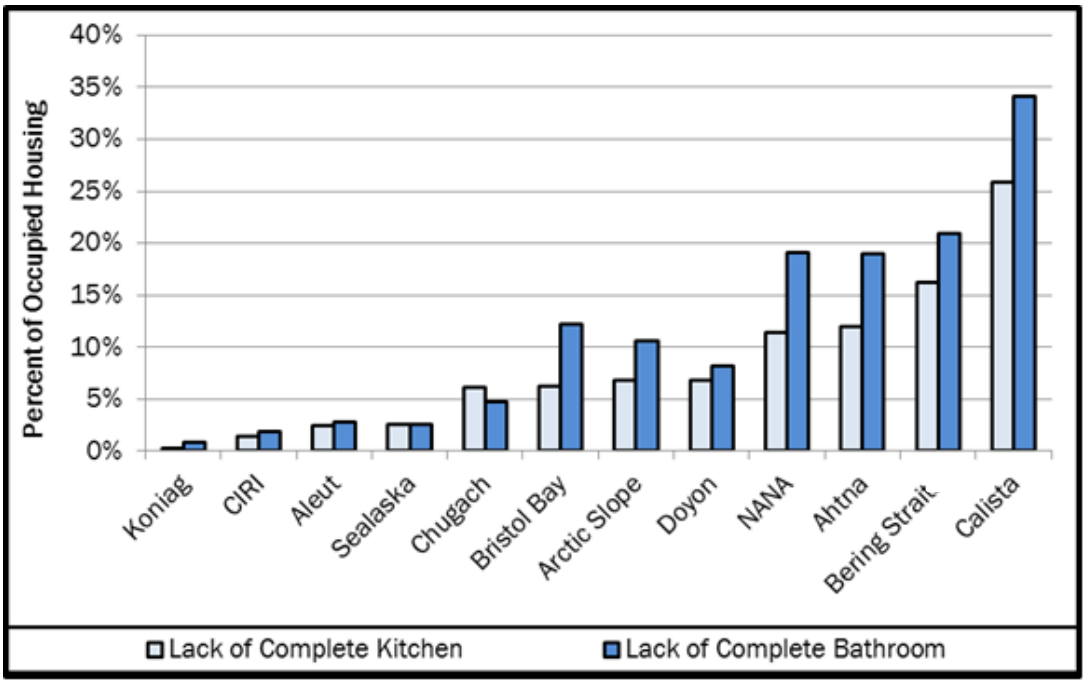
Alaska has significant housing needs with homes that are in disrepair and that lack facilities such as a complete kitchen, defined as having a stove or range, refrigerator and sink with running water, and indoor plumbing, defined as having hot and cold water, a shower or tub and a flush toilet. This is particularly true in rural Alaska. Pindus, Kingsley, Biess, Levy, Simington, and Hayes (2017) in a national report on housing needs of American Indians and Alaska Natives summarized problems as follows:

> Clearly, physical housing problems have been all but eliminated for U.S. households nationally, but that is certainly not true for American Indian/Alaska Native populations in tribal areas, where problems remain widespread.[68]

The report found that of all tribal areas, Alaska had the worst physical housing condition problems, with 36 percent of units surveyed having some type of problem.

American Community Survey data only reports on housing units lacking complete plumbing and/or kitchens and not general condition problems but information from the ARIS database tells a similar story as the national report: rural Alaska faces significant housing challenges (Fig. 55).

Figure 55: Estimate of substandard homes in need of retrofit by ANCSA region

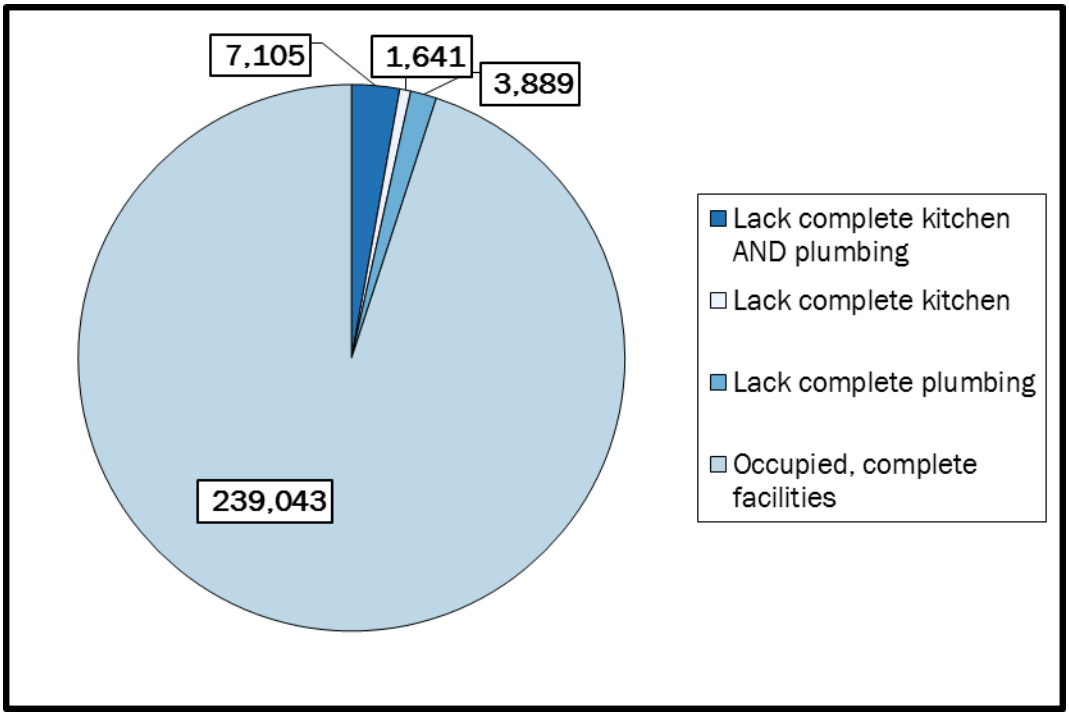


[68] Pindus, N., Kingsley, G. T., Biess, J., Levy, D., Simington, J., & Hayes, C. (2017). *Final Report: Housing Needs of American Indians and Alaska Natives.* Urban Institute. Retrieved from https://www.huduser.gov/portal/native_american_assessment/home.html

Statewide, an estimated 3.5 percent of housing units lack a complete kitchen and 4.4 percent of housing units lack indoor plumbing. In the rural regions of Calista and Bering Straits, 25.9 percent and 16.3 percent of housing units lack a complete kitchen and 34.2 percent and 20.9 percent of housing units lack indoor plumbing, respectively.

As shown in Fig. 56, the number of homes lacking a complete kitchen and plumbing is high, with 12,635 homes lacking one or both of these facilities.

Figure 56: Occupied housing units lacking complete kitchen, plumbing or both



Ventilation

For purposes of this assessment, ventilation systems are categorized into three types: *noncontinuous*, *continuous*, and *heat recovery*. Homes with noncontinuous systems either have no ventilation system installed or have ventilation equipment such as bath and kitchen exhaust fans that do not run on a continuous basis. Continuous mechanical ventilation systems are either exhaust-only or balanced systems that run continuously, or are based on sensors/timers that ensure fresh air is introduced to the home at a regular rate. Heat recovery ventilation systems, or HRVs, are a type of continuous ventilation system that recovers heat from exhaust air and transfers it to incoming fresh outdoor air, saving energy while providing healthy indoor air quality.

Fig. 57 shows the ventilation types found in single-family housing units in Alaska's regions. The Arctic Slope region has the highest adoption of continuous mechanical ventilation and HRV systems, with approximately 46 percent of homes having such a system installed. This is one reason that the Arctic Slope region has the fourth lowest percentage of housing units at risk for moisture and indoor air quality problems (see Fig. 60). The lowest percentage of installed ventilation systems in housing units is found in Sealaska and Ahtna regions where approximately 6 percent of single-family homes have continuous mechanical ventilation and approximately 5 percent have a HRV.

Figure 57: Ventilation types for single-family homes by ANCSA region

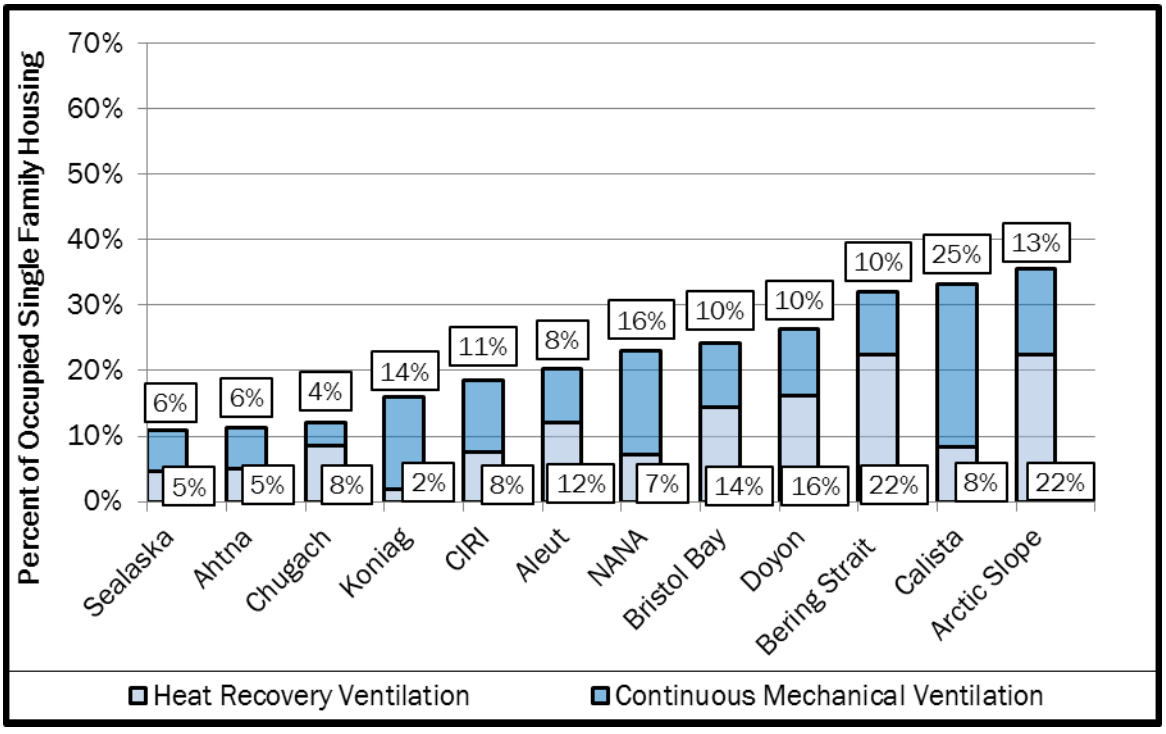
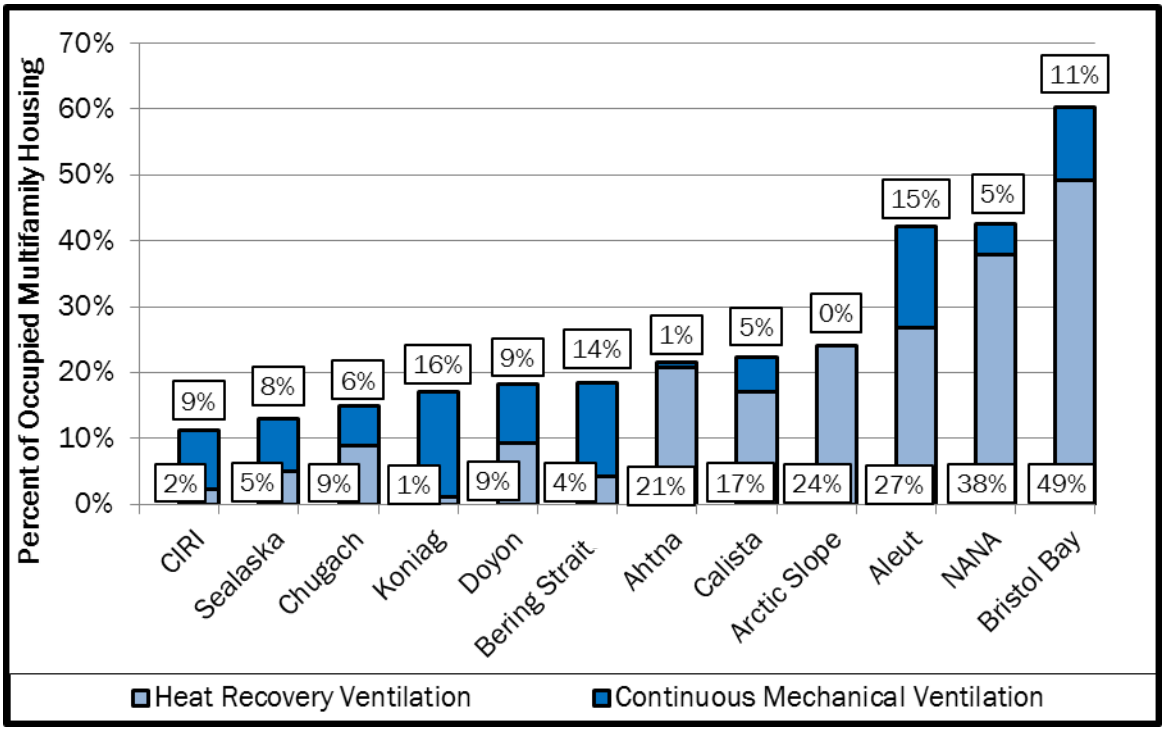


Fig. 58 shows the ventilation types found in multifamily housing units in Alaska's regions. The Bristol Bay region has been the largest adopter of ventilation strategies with approximately 49 percent of its multifamily housing units using heat recovery ventilation and another 11 percent using continuous ventilation. The lowest percentage of installed ventilation systems is found in CIRI and Sealaska regions where respectively, approximately 11 percent and 13 percent of multifamily housing units have either a continuous mechanical ventilation or HRV system.

Figure 58: Ventilation types for multifamily housing units by ANCSA region

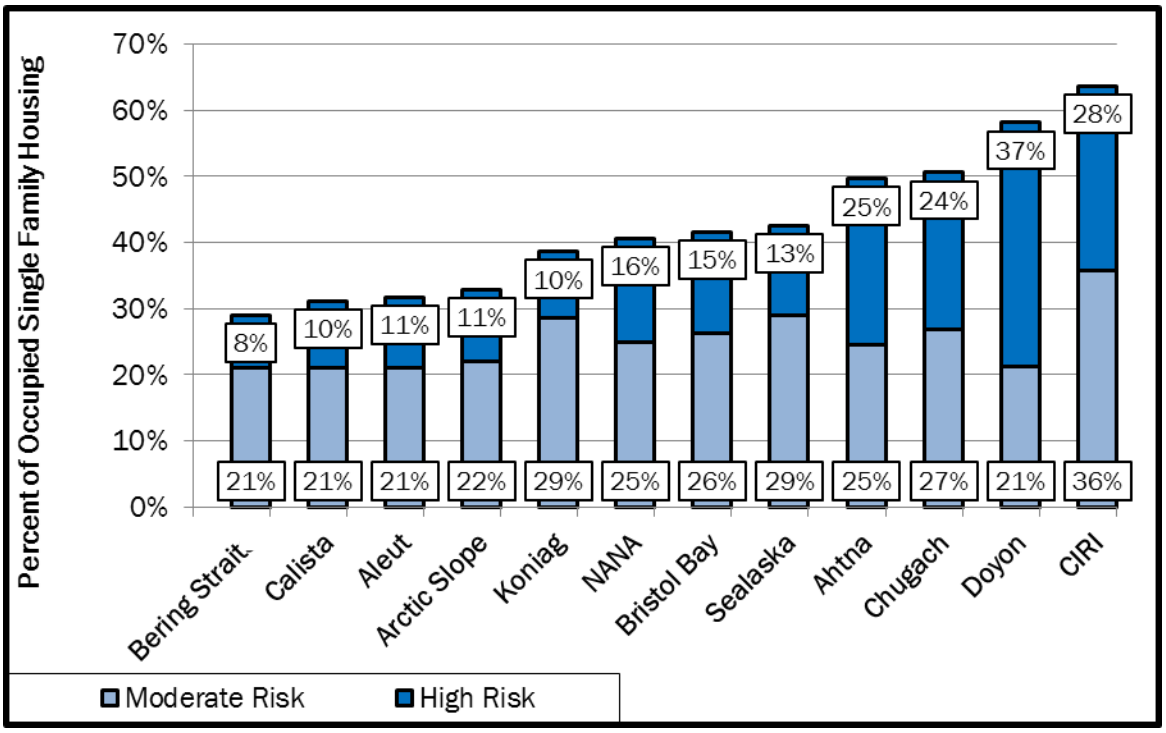


The rate of installation of continuous mechanical ventilation or HRV systems has increased. This is primarily due to AHFC's Weatherization Assistance Program and minimum energy code compliance requirements. In some geographic areas, the rate of installation of such systems has lagged behind the air-tightness improvements that have been made by homeowners participating in the Home Energy Rebate program. Adoption of continuous or heat recovery ventilation strategies in single-family housing is much more consistent across regions than in multifamily housing units.

Moisture and Indoor Air Quality Risks

Homes that are relatively airtight but lack a continuous mechanical ventilation system are at greater risk of moisture and indoor air quality problems than homes that have adequate ventilation from either a dedicated ventilation system or leaky building envelope. For this assessment, moderate risk is defined as homes that have either no ventilation or noncontinuous ventilation and have a building envelope tight enough to need ventilation. The air-tightness level for homes at moderate risk is defined as less than 0.5 natural air changes per hour because this is the cutoff where there is an increased risk of negative health outcomes.[69,70,71] Homes that have a natural air exchange less than 0.3 and don't have mechanical ventilation are considered high-risk. This metric indicates that data have shown homes to be at risk for moisture or indoor air quality issues, not that such issues have been detected. More than half of homes in CIRI, Doyon, Chugach and Ahtna regions are at risk of such problems (Fig. 59).

Figure 59: Single-family homes by ANSCA region at risk of moisture and indoor air quality issues

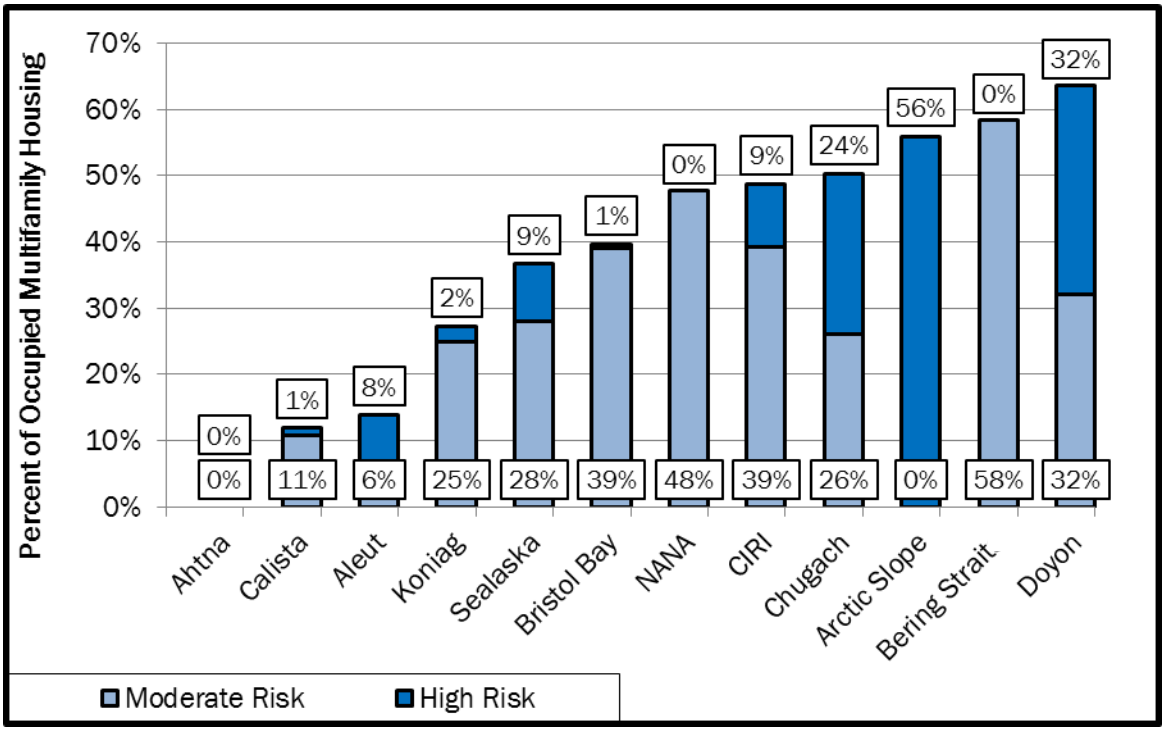


69 Offermann, F. J. (2010). IAQ in airtight homes. ASHRAE Journal, 52, 11, 58-60.
70 Sherman, M. H., & Hodgson, A. T. (2004). Formaldehyde as a basis for residential ventilation rates. Indoor Air,14, 1, 2-8.
71 Sundell, J., Levin, H., Nazaroff, W. W., Cain, W. S., Fisk, W. J., Grimsrud, D. T., Gyntelberg, F., Li, Y., Persily, A.K., Pickering, A. C., Samet, J. M., Spengler, J. D., Taylor, S. T., & Weschler, C. J. (2011). Ventilation rates and health: multidisciplinary review of the scientific literature. Indoor Air, 21, 3.

In the CIRI region, 36 percent of single-family homes are at moderate risk, and 28 percent are at high risk. The Doyon region has 21 percent of single-family homes at moderate risk, and 37 percent of homes at high risk. Despite similar adoption rates for ventilation strategies, this sizable difference of homes at high risk is largely driven by envelope tightness. Doyon region has tighter homes on average than those in the CIRI region. These regions are the most populous in Alaska accounting for more than 70 percent of the state's population. This suggests that a large percentage of Alaskans are at moderate to high risk for problems associated with moisture levels and indoor air quality. The Bering Straits region has the lowest percentage of housing units at risk for problems associated with inadequate ventilation. One factor influencing this is that the Bering Straits region has the third highest adoption of continuous mechanical ventilation and HRV systems, with approximately 32 percent of homes having such a system.

The Doyon and Arctic Slope regions have the greatest percentage of multifamily housing units at high risk among Alaska's regions (Fig. 60). While Doyon has the highest percentages (32 percent at moderate risk, 32 percent at high risk), Arctic Slope has a more acute issue with 56 percent of multifamily housing units at high risk for moisture and air quality-related issues. The regions at lowest risk are the Ahtna, Calista and Aleut. The Ahtna region has a high percentage of multifamily housing units that are drafty (50 percent).

Figure 60: Multifamily homes by ANSCA region at risk of moisture and indoor air quality issues

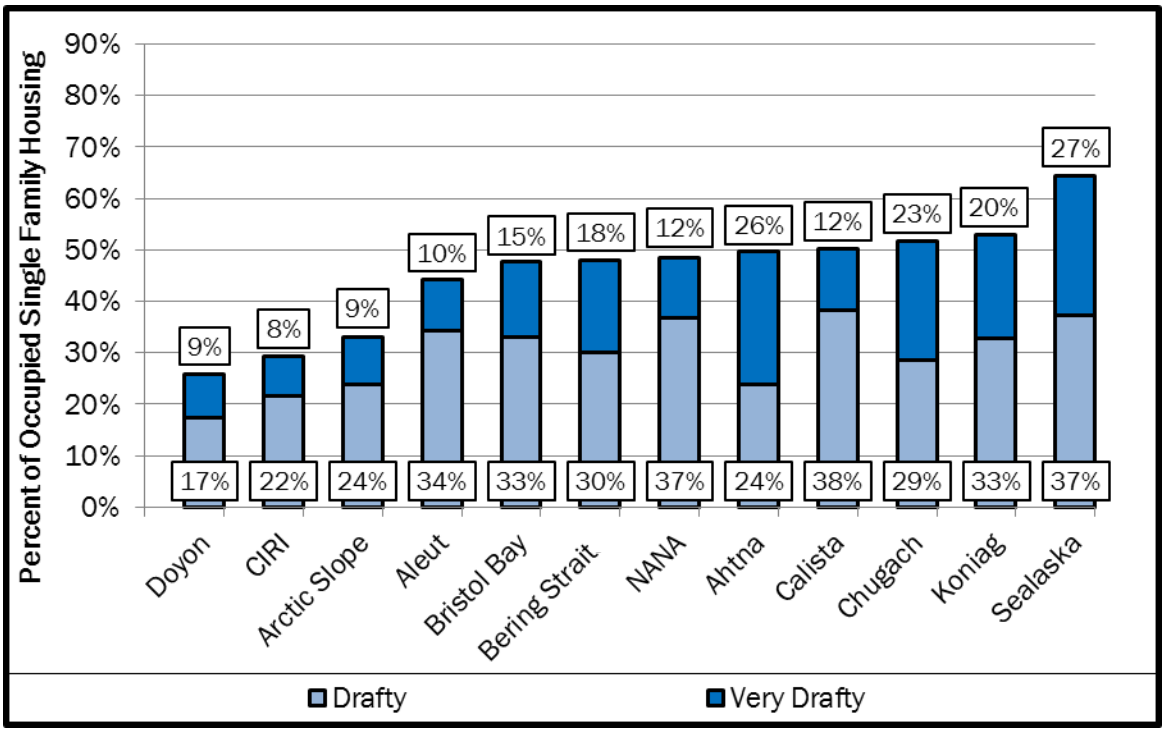


Draftiness

No industry standard quantifying draftiness exists, so the following definitions were used in this assessment: Drafty homes will see test results between seven and 12 air changes per hour at 50 Pascals (ACH50) when subjected to a blower door test. Very drafty homes will see test results of greater than 12 ACH50. By comparison, a home at four ACH50 will meet AHFC's BEES requirement for home tightness and will require some form of mechanical ventilation.

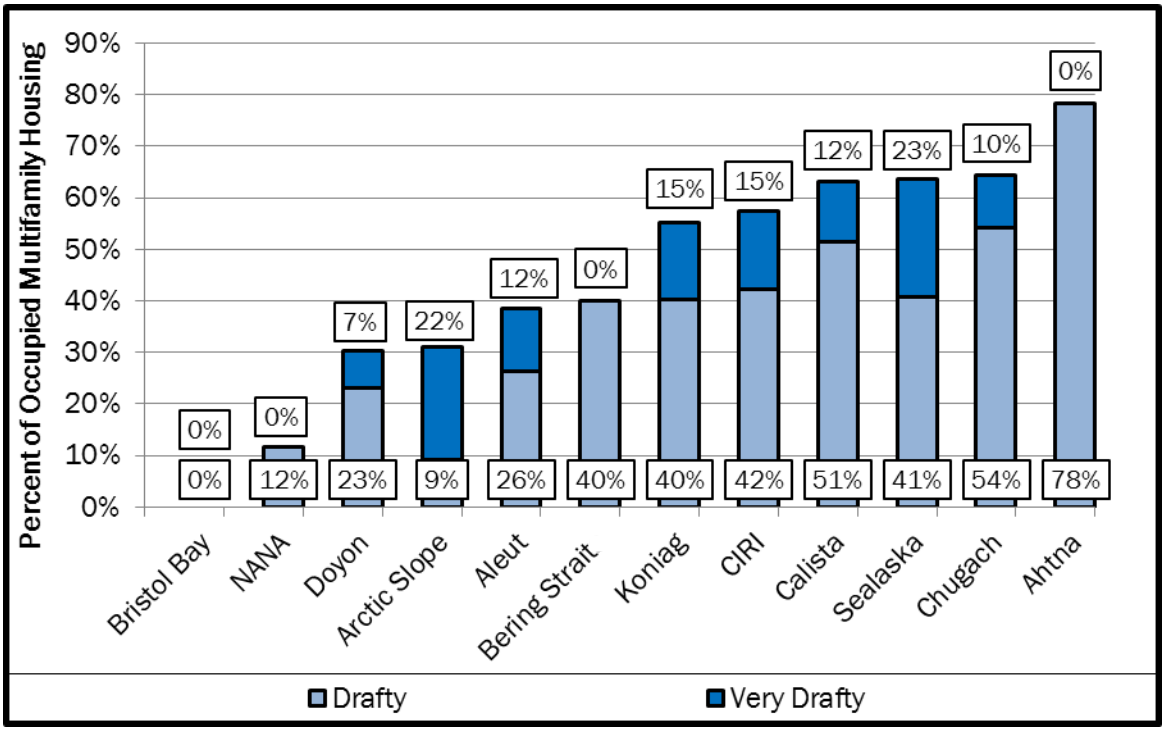
Among single-family homes, Doyon, CIRI and Arctic Slope regions had the smallest percentage of homes with draft issues. These regions also have the tightest homes on average. Sealaska, one of the mildest and wettest regions, has the highest percentage of drafty and very drafty homes.

Figure 61: Percent of drafty and very drafty single-family homes by ANCSA



Among the state's multifamily housing units, Bristol Bay and NANA regions had the smallest percentage of housing units with draft issues. These regions also have the tightest housing units on average. The Ahtna region has the highest percentage of drafty housing units but only a negligible percentage of very drafty units. Sealaska has the highest percentage of very drafty housing units.

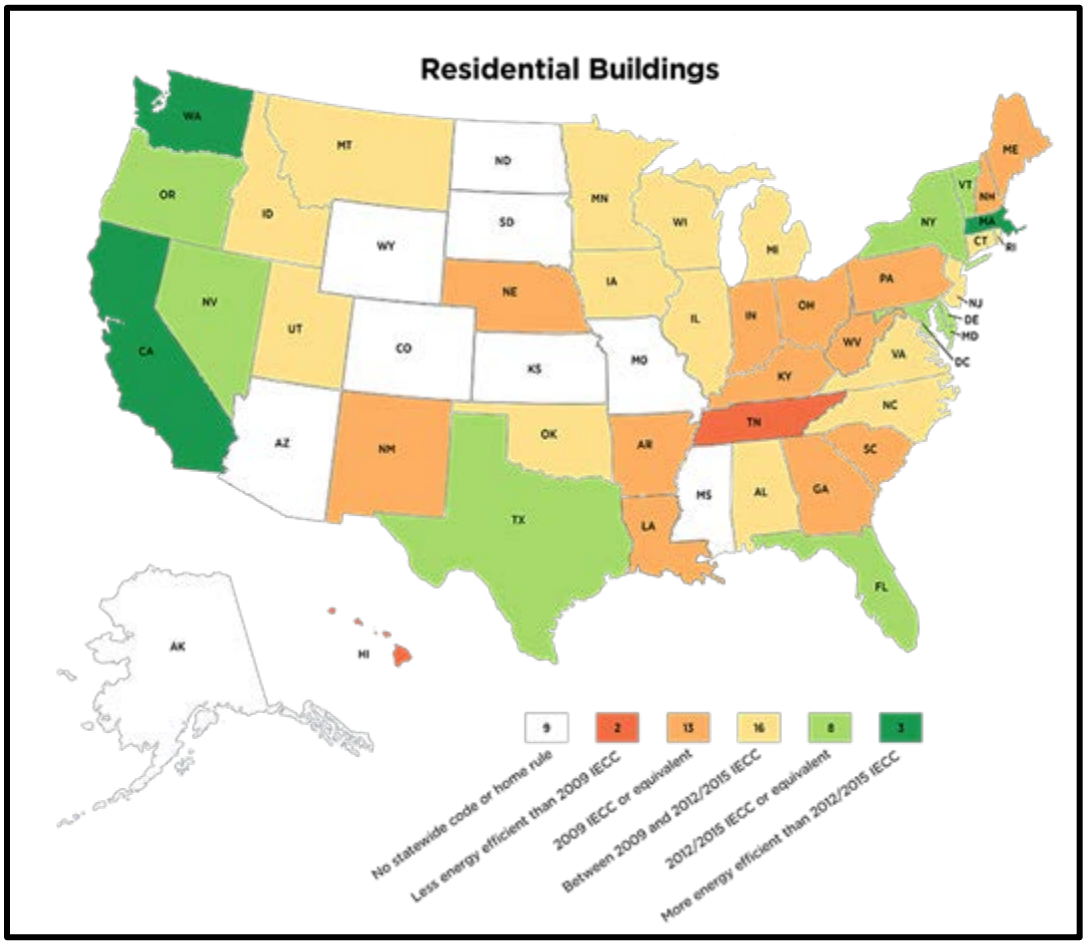
Figure 62: Percent of drafty and very drafty multifamily housing units by ANCSA



Residential Energy Programs

Alaska is one of nine states that does not have a mandatory building energy code for residential and/or commercial construction (Fig. 63).[72, 73] AHFC requires minimum energy code compliance for homes less than two years old that receive their financing.

Figure 63: 2017 residential building energy code status by state[75]



45 percent of Alaska Department of Labor's estimates of new construction between 2000 and 2015 have met AHFC's energy code minimum standard. The greatest number of new homes that have not met this standard are found in the Mat-Su borough portion of the CIRI region, where an estimated 10,880 homes have been built since 2000.

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[72] Berg, W., Nowak, S., Kelly, M., Vaidyanathan, S., Shoemaker, M., Chittum, A., DiMasciao, M., & Kallakuri, C. (2016). *The 2016 State Energy Efficiency Scorecard.* American Council for an Energy-Efficient Economy. Retrieved from http://aceee.org/sites/default/files/publications/researchreports/u1606.pdf

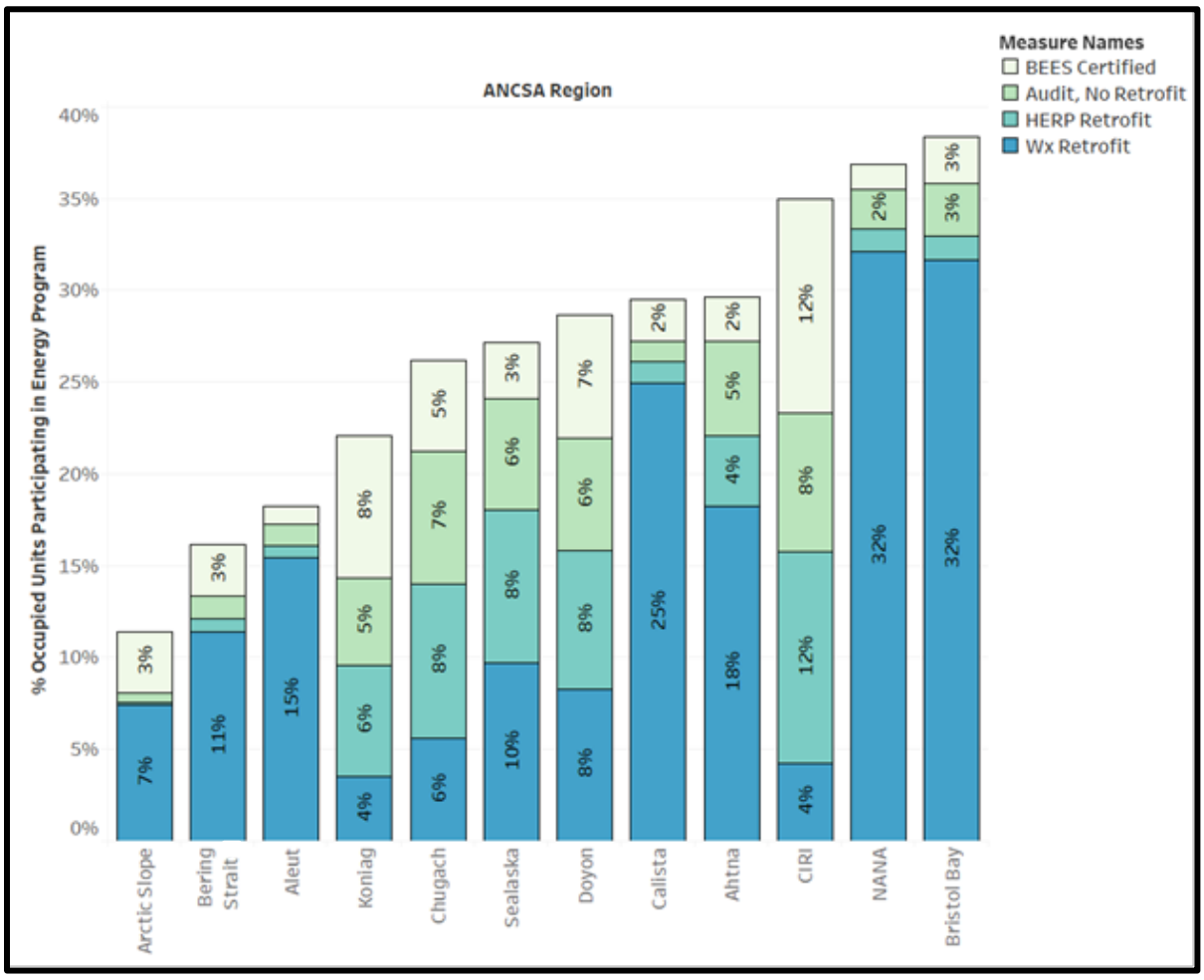
[73] U.S. Department of Energy. (2017). Building Energy Codes Program. *Status of State Energy Code Adoption.* Retrieved from https://www.energycodes.gov/status-state-energy-code-adoption. Accessed 8/28/2017.

Two retrofit programs have focused specifically on residential space heating energy efficiency in Alaska: AHFC's Home Energy Rebate and Weatherization Assistance. Data for these programs are recorded in ARIS. The Home Energy Rebate program, which stopped accepting new applicants in March 2016, provided rebates to homeowners completing energy efficiency upgrades. The Weatherization Assistance program provides energy retrofits for households with demonstrated need.[74] These energy efficiency retrofit programs have been funded primarily by the State of Alaska and have proven effective at reducing residential energy use and costs in older construction.[75, 76]

The percentage of housing stock that has benefited from the Home Energy Rebate program or been served by weatherization retrofit programs, or been certified to meet AHFC BEES varies by region (Fig. 64).

[74] Burbage, M., & Flora, S. (2017). *Weatherization Operations Manual: 2017*. Alaska Housing Finance Corporation. Retrieved from https://www.ahfc.us/files/6314/9081/4358/wom2017.pdf
[75] Dodge, Kathryn, Wiltse, N., & Valentine, B. (2012). *Home Energy Rebate Program Outcomes*. Cold Climate Housing Research Center. Retrieved from http://www.cchrc.org/docs/reports/HERP_final.pdf.
[76] Dodge, Kathryn, Wiltse, N., & Valentine, B. (2012). *Weatherization Assistance Program Outcomes*. Cold Climate Housing Research Center. Retrieved from http://www.cchrc.org/docs/reports/WX_final.pdf.

Figure 64: Percent of occupied housing completing an AHFC energy program by ANCSA region



In the Bristol Bay region, 38 percent of occupied housing has participated in an energy program, the highest percentage in the state. The majority of Bristol Bay's coverage has been through Weatherization Assistance, with 32 percent of occupied homes being served through a weatherization retrofit. Occupied housing in the CIRI region has the greatest participation in the Home Energy Rebate program and AHFC BEES compliance, with 12 percent of occupied homes completing the Home Energy Rebate program and 8 percent BEES certified.

The lowest coverage occurs in the Arctic Slope region where 11 percent of occupied housing has participated. At one percent, the Aleut region has the lowest percentage of occupied housing that has been certified to meet BEES. The Koniag region has been served least in the weatherization program with 3.5 percent of occupied housing completing a retrofit. The Home Energy Rebate program saw the lowest participation in the Arctic Slope region where approximately 0.1 percent of housing units have completed the program.